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ABSTRACT

This training manual is intended for persons who will be employed on supply vessels or towboats which support ocean-based oil extraction operations. The text deals with the basic skills of marine towing procedures, boat handling, deck maintenance, cargo operations, and rope and wire handling. Additional sections treat the proper attitude of a seaman, U.S. marine laws and regulations, oil pollution, and energy choices. (WB)

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NAUTICAL EDUCATION FOR OFFSHORE EXTRACTIVE INDUSTRIES

SUPPORT OPERATIONS & SEAMANSHIP

G. L. HOFFMANN

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LOUISIANA STATE UNIVERSITY
CENTER FOR WETLAND RESOURCES
BATON ROUGE, LA 70803

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Plates 1-7 from U.S. Navy, Army, and Coast Guard technical manuals.

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1. CARGO OPERATIONS

An offshore supply vessel earns its keep by carrying cargo. All types of oil field freight are carried by these vessels.

The majority of material used by the offshore oil and gas industry is manufactured by steel and chemical companies. These materials are normally shipped from the factory by truck, rail, or barge direct to an oil company's terminal or to supply stores or public warehousing yards. The terminal fills field requirements from these storage points. Delivery from supply stores to the terminal is either by vendor truck, bus, or parcel post; delivery from public warehouses to the terminal is by outside trucking companies except when materials are picked up by a marine vessel for direct shipment to the field. All materials are shipped to the field by air or marine transportation.

The materials received at the terminal most frequently for shipment to operating field locations are the following:

Cement, drilling muds, and chemicals
Electrical control equipment and motors
Hardware and safety equipment
Paints, greases, lubricants, and fuel
Pipe, valves, fittings, and flanges
Compressors, engines, and pumps
Drilling tools and equipment
Groceries and drinking water

Helicopters are used to carry small pieces of equipment that are needed immediately, while crewboats carry priority cargo that is too large to be flown by helicopter. Supply vessels account for the large bulk of offshore cargoes that are delivered to field locations. These supply vessels are constructed with a large afterdeck area on which most supplies are carried. Below deck are bulk mud and cement tanks equipped with pumps and lines for pumping this cargo to the drilling platform. Outside walk-in refrigeration units provide storage space for fresh meat, dairy products, and groceries. Diesel oil and fresh water for use in drilling operations are carried in large hull tanks.

Fig. 1.1

1.1 Cargo Routing

A typical shipment will explain how the various events associated with the final delivery of a draft of cargo to the oil field are linked together:

Alliance Oil Company needs drill pipe for its operations in the Gulf of Mexico. The pipe will be purchased from Bethel Steel Corporation of Gary, Ind., for delivery to Alliance's terminal in Morgan City, La. From Morgan City the pipe will be carried by supply vessel to the field as needed.

First of all Alliance Oil sends a purchase order for the shipment of pipe to Bethel Steel. This purchase order specifies the type of pipe and notes the cost Alliance Oil will pay. Bethel ships the pipe by a variety of transportation methods from its Gary plant, and the pipe finally arrives at Alliance's terminal in Morgan City by truck. The truck driver presents a delivery receipt, also called a dock receipt, to the receiving clerk in a truck window at the terminal when he arrives. (An oil field terminal may have more than one of these truck windows and several receiving clerks, depending upon the volume of activity at the terminal.) On the dock receipt the shipment of pipe is fully described as to size, weight, and number of pieces.

The receiving clerk inspects the dock receipt and compares it with the purchase order Alliance sent to Bethel Steel. If there are any significant discrepancies, the receiving clerk notes them on the dock receipt. He next assigns a checker to go with the truck driver to check the shipment as it is unloaded and to show the truck driver where to park for unloading. This checker carries with him a copy of the dock receipt. If the cargo is damaged in any manner or if it is not complete as ordered, he makes an exception note on the dock receipt. This exception protects Alliance's interests.

After the shipment has been unloaded, the checker sends the dock receipt to the receiving clerk, who gives a copy to the trucker. This copy of the dock receipt is Bethel Steel's notification that the pipe has been delivered as ordered, and they will bill Alliance from this receipt.

1.2 Terminal Operations

Fig. 1.2 a,b

An oil field marine supply terminal is a service organization. It supports field drilling, construction, and production operations by supplying material and transportation. The terminal's functions include: transportation and communication services, material procurement, control, handling, storing, fabrication, and maintenance. An oil company may have several of these terminals, one near each of its drilling operations.

Terminals may take many different forms of construction. The two most common types are the pier and the wharf. A pier is a long, relatively narrow structure that juts out into the water perpendicular to the shoreline. A wharf is constructed along the shoreline and roughly parallel to it. Both types

have their advantages and restrictions. A pier provides more economical use of space as a number of oil field vessels may be docked on either side of the pier. However, in some places the waterway is not wide enough to accommodate a pier jutting out into the water and a wharf is preferable. A wharf has more storage and working space available near the vessel on which supplies will be loaded.

The functions of the oil field terminal are divided into three groups: Administration, Operations, and Transportation and Communications.

Fig. 1.3

Administration. The administrative section is responsible for terminal office services, material procurement, accounting, and inventory control.

Operations. The operating section is responsible for the physical handling of material, both incoming and outgoing. It must ensure quality control in its receipts for material and equipment and maintain material in custody. This group is responsible for proper care in packaging, handling, and shipping material for safe transit to its destination. Terminal facilities and equipment are provided to effectively and safely carry out these activities. These facilities and equipment include a warehouse for storing materials and supplies that require protection from the weather, a yard for storing tubulars (pipe) and other large equipment, a heliport, a waterfront dock, and mobile lifting cranes and fork trucks for moving materials.

Transportation and Communications. The transportation and communciations group is responsible for providing all modes of transporation and communication services. The function of transporting personnel and material offshore is controlled by the transportation section, which arranges, coordinates, and schedules all marine vessel, airplane, and helicopter requirements to and from the field operations. The communications section installs and maintains all radio and telephone systems on marine vessels, airplanes, helicopters, and at the terminal and in the field.

Fig. 1.4

It is extremely important that the terminal be laid out in such a manner that incoming cargo does not get mixed with outgoing cargo, and that optimum use is made of the space available. A draft of cargo stacked on the pier for loading aboard a vessel due to come in from the field in two days may interfere with the loading and discharge of other cargoes.

Facilities are usually designed to provide for segregation and continuous inventory of different types of cargoes. In addition, many terminals are provided with a different, marked, storage area or collection point for materials to be shipped to each field location. This could be termed a pickup

point. For instance all of the materials that have come into the terminal for shipment to the various company platforms in Eugene Island Block 86 over a period of time are placed at the Eugene Island pickup point.

A principle objective of the operations department and its materials handling group is of course to provide for minimum handling of the cargo. Ideally, it would be best to offload cargoes directly from the truck to the vessel that carries the material to the field. However, this rarely occurs except with priority cargoes where the boat is waiting for the truck of goods to arrive. Usually the material is offloaded at the terminal as specified by the dock boss or superintendent where it may be conveniently loaded aboard the vessel when she comes in.

All materials for field locations that are received by the terminal are checked for special or routine handling. Instructions for special handling may be shown on the delivery ticket, purchase order, or separate memo. Care is taken to ensure that all handling instructions are followed.

1.3 Cargo Handling Equipment

Fig. 1.5

Certain types of material-handling equipment may be seen at any oil field terminal. Each is designed to carry out its own specific duties, but many are used in combination with others or may be designed to perform a number of tasks.

The Tractor-Trailer Combination. The tractor truck is a power unit in the form of a truck with short chassis and no body used in a combination highway freight vehicle. It is usually gasoline powered and is designed to pull one or more trailers. The trailer has a flat bed and four wheels and is designed to carry fairly heavy loads. These trailers are constructed in various ways. Some have four wheels that turn directionally; in others only the two front wheels turn. The trailer bed is usually made of a hard wood bound with steel, although the entire bed may be covered with steel plate for heavy duty work.

The tractor-trailer combination performs well in moving cargo about, but it requires a relatively flat, smooth surface for operation.

Fig. 1.6

The Forklift Truck. The forklift, perhaps the most widely used piece of cargo handling equipment, is usually gasoline driven. However, it may be driven also by electricity, diesel, or engines using liquefied petroleum gas.

Two parallel steel bars extend from the front of the forklift truck and are used to carry pallets of cargo. The

thin and beveled bars are attached to the truck by a sturdy frame. Most of the trucks are equipped with hydraulic lifting devices to raise and lower the bars or forks for stacking cargo. Some forklift trucks can stack loads as high as 15 feet. There are a number of special attachments for forklift trucks that enable them to handle many different cargoes.

Fig. 1.7

The Pallet. The pallet was designed to be used in conjunction with the forklift truck and rope slings. It is made of wood and may be single or double faced. A single faced pallet has only one deck or top surface while the double faced pallet has both an upper and a lower deck.

The pallet is light, provides a solid floor for the stacking of goods, and can easily be tiered or stacked.

Fig. 1.8

The Two-Wheeled Hand Truck. In limited working room or where small loads of cargo are moved infrequently, the wheeled hand truck is an old and useful tool. This piece of equipment, depending upon its size and construction, can handle loads ranging from 200 up to 600 pounds. Proper loading of the truck makes it easy to handle and allows for the movement of many articles at once.

Fig. 1.9 e-f

Cranes. The shoreside crane is the method by which most equipment is loaded onto oil field marine vessels. These cranes can be used together to lift heavy loads. A cargo runner or whip is dropped from the boom of the crane. This runner has a heavy metal ball at the end with a hook to which the sling is attached. Most cranes are portable and self-propelled although a few are permanently installed in position on the dock.

Fig. 10, a,b

The Sling. 'Sling' denotes a wide variety of devices that are attached to cargo to hoist it aboard a vessel. Endless fiber rope slings consist of a length of line, usually manila, of about 36 feet in length with its bitter ends spliced together to form an 18 foot length sling. These slings usually handle bagged goods, single lightweight boxes, and reels of wire.

Fig. 1.11

The fiber rope snotter and its sister, the wire rope snotter are simply lengths of line or wire with an eye spliced in each end and a sliding hook riding between the eyes. The wire rope snotter is widely used in the oil patch to hoist pipe and steel products.

Fig. 1.12

The fiber rope net is about 12 feet square and made of interwoven 2 inch fiber rope. It can be used to handle bagged goods, single cases, or heavy duty drums.

Fig. 1.13

The pallet sling consists of two bars that slide between the decks of a double-faced pallet at each end. The arms of the sling are separated by spreader bars to prevent the sling from bearing on and damaging the pallet and cargo when a load is placed on the sling.

1.4 The Vessel's Loading and Discharging Equipment

Fig. 1.14

Bulk Mud and Cement Systems. Bulk mud and cement systems installed in offshore supply vessels are designed to load dry drilling muds and cement in bulk at the dock and transport and transfer the material to the oil field platform or drilling rig.

In recent years the installation has taken the configuration of four or more tanks installed in compartments below deck. These tanks, called pea tanks, have a hatch opening to the weather deck. The hatch, dogged down, is covered and protected with a manhole cover. Cargo is pumped into and out of the tanks through fill and discharge lines on either side of the vessel. Valves for control of this system are located on a panel usually on the boat deck on the after side of the house or in the wheelhouse. A huge diesel-engine powered compressor in the engine room forces cargo from the tanks. Air pressure is also used for opening and closing valves in the system. Tanks are filled at the dock by pressure loading using the dock equipment.

The tanks should always be thoroughly cleaned when a different cargo from the last is loaded, such as putting mud in a tank that has been used to carry cement. Every attempt should be made to keep moisture out of the tanks and the lines leading to and from them. Failure to follow these procedures will result in plugged and damaged lines and hard residue in the bottom of the tanks. This is why water filters or traps are installed in the air lines leading to the tanks. Most vessels also carry spare O rings and gaskets for the system.

Some vessels have cylindrical bulk tanks installed on deck along with a compressor for performing the same functions as in-hull tanks.

Ship's Rigging. At this point we will depart from the oil field supply vessel temporarily to examine the boom and fall systems aboard large oceangoing cargo vessels. Although this equipment is not installed aboard oil field supply vessels, you may someday have opportunity to use this equipment and it is important that you become acquainted with its basic components.

The married fall system is the most common system found aboard merchant vessels for the loading and discharge of

cargo. In this system two booms at each hatch are used to move the cargo about. The cargo whips, or runners, on the two booms are joined or married together. This rig is also referred to as the yard and stay, or burton system. The terms yard and stay come from the early days of shipping before ships had booms. A block was usually spotted over the center of the hatch and attached to the ships mast stay. A fall run through this block could be used to lower or lift cargo from the hatch. Another block was attached to the end of the yard arm. A runner through this block enabled cargo to be lifted from the pier up to the ship or to be lowered from the ship to the dock. The two terms have stuck although the two blocks are no longer attached in this fashion. In using the married fall system one boom is spotted over the hatch and the other is spotted so that its outer or upper end is over the dock.

Fig. 1.15a

Figure 1.15a illustrates how this system works. A pallet of cargo is being loaded aboard the ship. The cargo on the dock boom is taken in until the draft of cargo clears the rail of the ship. At this point the fall on the hatch boom is taken in and the dock boom fall slacked. Both falls carry the load and the pallet load is stopped over the center of the hatch. Both falls are then slacked away until the cargo rests on the deck in the hatch. For offloading cargo the procedure is reversed.

Fig. 1.15b

Besides the cargo falls, the winches, and the booms, a number of other pieces of auxilliary equipment and rigging is necessary to operate the yard and stay or married fall system. These various parts are shown and labeled in Figure 1.15b.

The booms (7) can pivot in two planes. Their vertical movement is controlled by the topping lift (13). The transverse movement of the booms is controlled by the outboard or working guy (14) and the midship or schooner guy (16). The midship guy is also known as the spanner guy.

At the bottom of each boom a fitting known as a gooseneck (6) allows movement in the two directions mentioned.

The cargo fall (9) leads directly from the winch drum to the heel block (10). The heel block and the gooseneck fitting are usually made up in one assembly. The fall then leads up the boom through lizards or fairleads to the head block (11) and then to the cargo hook (12).

When it is time to top the booms the topping lift is led to the winch through fairleads. In the figure the topping lifts are shown secured to cleats. Before taking the topping lifts off of the cleats they must of course be stopped off. It is very important that the entire operation proceed without any sudden jerks or slackening of the lines or the topping lift may fail, causing the boom to fall. Most newly constructed vessels have the topping lifts lead to a topping lift winch

and adjustment is made by the simple touch of a button. On some ships the topping lift consists of a single wire attached to the spider band. It is fairleaded through a topping lift block on the crosstree from which it runs down to the deck. The lower end of the topping lift has a flounder plate attached. The flounder plate is a triangular plate with holes punched in all three corners. The lower end of the topping lift is attached to one corner. A bull rope is attached to one corner and a bull chain is attached to the third corner. The boom is raised or lowered by first taking the weight of the boom on the bull rope and unshackling the bull chain. The bull rope having been led to a winch is then taken in or paid out until the boom is at the desired height. The lowest link of the bull chain is then shackled to a padeye on deck. The bull rope is then slacked off until the chain has all the weight.

An optional item of rigging, a preventer guy, is attached to the head of the boom and led to a fitting on deck. Its purpose is to prevent the boom from swinging should the regular outboard guy part. As such it should be secured to the deck close to the regular guy but not on the same fitting. The preventer should be taken up until it bears the same stress or is as tight as the regular guy. If it is slack, the movement of the boom with a load will easily snap the preventer when the regular guy fails.

Prior to entering port, the booms at the hatches that will be worked are spotted by the deck crew. On older ships this entails quite a bit of work coiling and uncoiling lines and taking lines off of and putting them on winch drums. After departure from port, if the voyage to the next port of call is long, the booms are cradled or lowered.

Maintaining the cargo gear is a continuing job aboard oceangoing freight vessels. Blocks must be checked and greased and falls must be slushed down and inspected. Slushing down consists of dipping a rag into a bucket of slush (grease, oil, and rust inhibitors) and coating the wire by hand.

At some hatches on the vessel, special heavy lift booms are installed. Designed to handle much greater loads than the other booms, these booms and their wires and blocks are gigantic. Unlike the other booms that remain fixed and do not swing or pivot when worked, the heavy lift boom picks up a load and is then topped and swung into position pivoting up and down and moving traversely.

The closer the boom is to the horizontal, the less the weight that can be lifted. On the heavy lift boom a meter indicates the safe working load according to the angle of the

boom. The safe working load of ordinary booms is painted on the boom for each angle. It is up to the mates of the vessel to see that the safe working load is never exceeded, for doing so would be dangerous to everyone in the vicinity.

1.5 Cargo Stowage

Proper stowage of the cargo will prevent costly claims, damages, and trouble for the vessel's master and crew, and even loss of life. Although others at the terminal and other leading points share to an extent the responsibility for the proper stowage of cargoes, it is the vessel's master and mates who will finally be held responsible for the loss of improperly stowed cargo.

Segregation of Cargo. Although you may not have given it much thought, you have probably observed the principle of segregation of cargo. Segregation of cargo means the stowage of different types of cargoes in different parts of the vessel so that one type cannot damage the other. For instance, a wet cargo--liquids in containers--should be kept away from dry cargo, which cannot possibly leak but which could be damaged by a wet cargo. The reason for segregation of these two types of cargo is that leakage from the wet cargo may find its way to the dry cargo and ruin it. For this reason wet cargoes should have stowage where any leakage will find its way immediately to drains without flowing to dry cargoes.

Heavy cargoes should be properly segregated from light cargoes. This means that cargo should be properly stowed vertically (stacked) with the heavy cargo on the bottom. You can imagine the damage from stowing a drill collar on top of a carton of canned goods.

Explosives and other dangerous articles must be properly segregated from other cargoes according to the regulations set forth in Coast Guard regulations, CG 187.

Dunnaging. Proper dunnaging is a second principle to remember for the proper stowage of cargo. Dunnage refers to loose wood used to protect the cargo and the vessel. This wood most commonly comes in the form of 1 x 6 inch boards of 10 to 12 feet long.

The purposes of dunnage include:

1) Protecting the cargo from contact with free moisture

2) Preventing the cargo from being crushed

3) Distributing the weight of cargo over the deck

4) Ventilating the cargo

Dunnage laid down properly on the deck of a supply vessel will allow water shipped on deck to drain beneath the cargo. Dunnage is of course not always necessary, especially when the cargo is already sitting on a pallet. However, cargoes such as sacked chemicals must set up off the deck either on a pallet or on top of dunnage.

Dunnage is used to prevent the cargo from being crushed by shifting or to lay down a floor between different tiers of cargo. In this category are toms, shores, and braces.

Tomming is the process of securing cargo by running a timber from an upper support down to the cargo. This piece of timber is called a tom. Shoring is the process of securing cargo from shifting by running a timber from a lower support up to the cargo. The shore thus runs from a lower level up to the cargo. Bracing is the use of horizontal timbers running horizontally between a support and the cargo.

Tomming is the most efficient method of the three. When a weight such as a surge of water pushes against the cargo, the movement of the cargo against the tom tends to push the cargo down against the deck. With shoring such an incident would tend to lift the cargo from the deck.

Where heavy concentrated loads are placed on the after deck, dunnage distributes the weight of the cargo over a greater area and facilitates placing a sling under the cargo to offload it.

Lashings. In most cases lashings are used to secure deck cargoes. Lashings are of steel chain, wire rope, or steel strapping; to serve their purpose they must be tight with all the slack out. A chain lashing around a joint of drill pipe will soon part if the pipe is allowed to roll transversely with the motion of the vessel. Chain lashings are usually tightened by means of the chain tightener, or binder. This device has hooks on both ends. It is placed on the chain after both ends have been secured, movement of the handle from the perpendicular down to a position parallel to the chain takes up slack in the chain. The handle on the binder should be lashed shut after it is closed to prevent its popping open. Turnbuckles are also used to secure lashings and to take out slack. After the turnbuckle has been tightened as much as possible a stout piece of wood or steel pipe placed in the barrel of the turnbuckle will prevent it from backing off. Turnbuckles and chain tighteners should be stored inside and oiled frequently. It is important that the master of the vessel keep lashings, turnbuckles, and chain tighteners aboard the boat. If this isn't done, one day he will pull into the terminal and find that the only thing that he has left to secure the cargo is a couple of rusty chain binders that don't work.

Placement of the Cargo. Where the vessel is to make three or four stops at various platforms, it costs time and trouble to move cargo about on the boat and to loosen and then replace lashings. If possible, cargo for a specific location should be placed together on the vessel. Or, the location of a platform's crane may mean that it is best to place the cargo on a particular side of the deck or at the stern of the vessel. The master's personal knowledge of his offloading locations will determine some stowage.

Stowage of Bagged Chemicals. Chemicals in bags should be given inboard stowage as far forward as possible. The reason for this is the susceptibility of the bags to damage by water that comes over the stern when backing the vessel or water that comes on deck due to the motions of the vessel in the seaway. Pallets of bagged chemicals are usually covered with a heavy plastic and the crew should make every effort to see that this covering remains in place. Most chemicals are very expensive and create a slipping hazard when spilled on deck. Many are extremely difficult to clean up.

Stowage of Pipe. Pipe is loaded and discharged usually by crane, however, specialized equipment is sometimes used at shoreside pipeyards. Wherever possible the pipe should be stowed completely across the vessel from side to side and flush across the top. Avoid stacking the pipe on one side of the vessel, in which case it is liable to roll transversely. Beware of damage to the vessel's superstructure while loading and discharging. While any type of heavy cargo, especially pipe, is being loaded or discharged, keep out from under the load. After it has been loaded aboard the vessel the pipe should be lashed securely and chocked if necessary to prevent its movement. Seas might be extremely calm while the pipe is being loaded, but weather can change rapidly and it will be up to the vessel's crew to secure the pipe if it begins rolling in rough weather. This is often impossible and damage and loss of stability may result.

Fig. 1.16 a,b

Dangerous Cargo. There are seven Coast Guard classifications of dangerous articles that may be carried as cargo. They are: (1) explosives; (2) flammable liquids; (3) flammable solids; (4) oxidizing materials; (5) corrosive liquids; (6) compressed gasses; and (7) poisonous articles.

The U.S. Coast Guard regulates the handling and stowage of these articles including the entire process of receiving, handling, stowing, and delivering them. The regulations are contained in CG 187, Explosives or Other Dangerous Articles On Board Vessels.

Included in the regulations are requirements that packages must be marked with a special colored label describing

their contents and handling. A green label, for instance, indicates nonflammable compressed gases, while a red label indicates flammable liquids or gases; a skull and crossbones indicates poisonous articles. Listed below is a description of some of the various terms used in the regulations.

Explosives, Class A: A dangerous explosive. No label. Some examples are dynamite, ammunition with war heads or explosive bullets, and black powder.

Explosives, Class B: Less dangerous explosives. No label except fireworks. Some examples are ammunition, smokeless powder, and fireworks.

Explosives, Class C: Relatively safe explosive. No label. Some examples are ammunition for small arms without explosive bullets, toy caps, fuses and primers.

Flammable liquid: Any liquid that gives off a flammable vapor at or below a temperature of 80°F. Red label. Some examples are alcohol, gasoline, carbon disulfide.

Flammable solid: A solid substance other than an explosive that is liable to cause fires during transportation through friction, absorption of moisture, or other cause. Yellow label. Some examples are matches, motion picture film, and charcoal.

Oxidizing materials: Any substance that yields oxygen readily, which might stimulate the combustion of organic material. Yellow label. Examples are sodium nitrate and calcium chlorate.

Corrosive liquids: A strong mineral acid or other corrosive fluid that might cause fire when mixed with chemical or organic matter or that might damage other freight on contact. White label with black printing. Examples are nitric acid and sulfuric acid.

Nonflammable compressed gas: Any material having a vapor pressure exceeding 25 pounds per sqare inch at a temperature of 70°F. Green label. Examples are oxygen, nitrogen, and helium.

Flammable compressed gas: Any flammable liquid material that has a Reid vapor pressure exceeding 25 pounds per square inch at a temperature of 100°F. Red label. Examples are hydrogen and acetylene.

Class A Poisons: Extremely dangerous poison gas or liquid. Very small amounts of the vapors when mixed with air are dangerous to life. White label with red printing. Examples are mustard gas and phosgene.

Class B Poisons: A liquid or solid substance of such a nature that it is chiefly dangerous by external contact with the body or by its being taken internally. White label with red printing. Examples are arsenic, cyanide, and motor fuel antiknock compound.

Class C Poisons: Liquids or solids that on contact with fire or when exposed to air give off intensely irritating fumes but excluding any poisonous article. White label with red printing. Examples are tear gas grenades.

Class D Poisons: Radioactive materials above a specified level of activity. White label with red printing.

Combustible liquids: Any liquid that gives off flammable vapors at or below a temperature of 150°F, and above 80°F. No label. Examples are turpentine, kerosene, and paints.

A licensed deck officer must supervise and be present at all times during loading or discharge of any of the articles mentioned above.

Passenger vessels are prohibited from carrying all Class A explosives, all Class A poisons, highly corrosive liquids, such as sulphuric acid, highly flammable liquids of Grade A and B such as commercial and aviation fuel and natural gas, and light naptha and benzine or highly flammable solids.

An example of the regulations on the stowage of dangerous articles is that of flammable liquids. When these are carried they must all be carried on one side of the vessel's centerline if stowed on deck. A 25-foot clearance is required from lifeboat stations and entrances to quarters. They cannot be stowed closer than 20 feet to bulkheads that are heated unless the bulkhead is sufficiently insulated.

An important note that should be included here is that compressed gas cylinders must not be accepted for shipment aboard the vessel unless they have adquate protection for the valves and fittings on the cylinders. To meet this requirement the cylinder may be (1) provided with a valve protection cap that screws on over the top of the valve assembly, (2) of a dished head design in which the valve is recessed into the cylinder, or (3) completely boxed for shipment so that the valve assembly is completely enclosed and protected.

The cylinders should be stowed on their sides unless racks are provided for carrying them vertically. Cylinders of flammable compressed gas must not be closer than 8 feet to the vessel's side. Those of nonflammable gas should be at least 3 feet from the vessels side.

Dangerous cargo must be listed on a separate manifest called a Dangerous Cargo Manifest. This manifest is provided the vessel's master by the terminal and should list all of the dangerous cargo along with its destination, label, description, and special handling instructions.

Fig. 1.17

Stowage of Drums. Drums should be stowed on end with the bung, or opening, up. Drums may be tiered and stacked one directly on top of the other if a layer of dunnage is placed between tiers. Lashings and chocks should be used to secure the drums. In some instances it is better to stow empty drums bottom up to prevent them from shipping water.

Fig. 1.18 a,b

Stowage of Steel Plates. Steel plates should be stowed on deck flat or horizontal to the deck. A number of 2 x 4's should be placed on the deck before loading the plates to facilitate the use of slings when unloading. Where necessary, the plates must be chocked off to prevent sliding or shifting.

Stowage of Reels. Reels should always be stowed on their sides unless they are light enough to be easily capsized by one or two men. The axis of the reel should be athwartship as the movement of the ship is least in a fore and aft position. When reels are carried with their axis parallel to the fore and aft line of the vessel the rolling motion of the vessel can cause lashings to chafe and break.

Fig. 1.19 a,b

Most reels have an arrow on them indicating the direction in which they should be rolled if necessary. Some reels have coverings and these coverings should always be maintained intact to prevent damage to the material on the reel. Care should also be exercised to prevent puncturing the hose or cable on the reel as some types of cable are constructed such that one puncture hole in the cable exterior will cause costly damage to the entire reel of cable.

The reels should be securely lashed and chocked to prevent their movement in a seaway.

Fig. 1.20 a,b

1.6 The Manifest

The manifest is made up by terminal personnel. On the manifest is listed the descriptive name of the cargo, the number of packages or the weight or both, the destination of the cargo, and other data. A copy of this manifest is given to the captain of the vessel. Most oil field companies include a statement that the captain of the vessel must sign which generally says that all cargo listed has been placed on board and properly secured. The captain's signature on the manifest thus makes him directly responsible should anything be lost or damaged due to improper stowage. For this reason the captain of a crew or supply vessel should take every

Fig. 1.21

precaution during loading to see that all cargo is properly placed and secured according to his own criteria even though it may take extra time and effort. The loading gang may have never worked on an offshore vessel and in any case will not know as well as the captain what is the proper stowage on his vessel. The captain should beware that favorite saying of dock workers. "We always do it this way!"

1.7 Cargo Measurements and Terms

The objective of a ship operator or owner is to plan a load of cargo for the vessel that will use up all of the cargo deadweight of the vessel and at the same time consume all of her available cubic capacity. When the vessel is stowed to volume capacity and is down to her maximum legal draft marks she is said to be full and down.

Let's say, for example, that you are the owner of a large vessel that can carry 500 tons of cargo. The space available for carrying the cargo is 20,000 cubic feet. You charge by the ton for carrying cargo, and two companies have approached you to carry some of the cargo for them to another port. One company has a cargo of 200 boxes of pillows. The total shipment of pillows weighs 100 tons but takes up 20,000 cubic feet. The other company wants to ship 50 crates of machine parts that weigh 400 tons total and take up 10,000 cubic feet. It is obvious that you should accept the machine parts for shipment because you charge by the ton. If the ship were loaded with the machine parts she would be neither full nor down. If the cargo of pillows were accepted, the vessel would be full but not down.

Thus careful consideration must be given to the nature of the cargo when considering the best utilization of the space aboard a vessel.

There are a number of different weights that are used to rate cargoes. One is the long ton, equal to 2,240 lbs. Another is the short ton, which is equal to 2,000 lbs. A measurement ton consists of 40 cubic feet; it is a unit of measurement instead of a unit of weight. It is used as a volume basis for calculating freight weights. You can see that the ship would have necessarily charged by the measurement ton had he carried the cargo of pillows.

A number of terms are used to describe individual packages of cargo when discussing weight. The gross weight of a box of cargo would be the total weight of the box and the cargo inside. The net weight of a box of cargo would be the weight of the cargo inside the box. The tare weight of the box of cargo refers to the weight of the box or other container in which the cargo is being shipped.

If the vessel operator knows that he has so much space available to carry cargo and he plans to carry a certain cargo, the next thing he needs to know is how much of the cargo he can carry in the space available. A ton of one type of cargo may take up much less space than a ton of another cargo. For this reason another criteria in use in planning the stowage of cargo is the stowage factor, the number of cubic feet required to stow one ton of that particular cargo. For instance, if the stowage factor of a particular cargo is 56, this would mean that 56 cubic feet of space are required to stow one ton of cargo. The stowage factor of any cargo can be determined by the equation:

$$f = \frac{2,240 \times v}{w}$$

where

v = volume of the cargo in cubic feet
w = weight of the cargo in pounds
f = stowage factor

For example, a certain cargo weighs 1,000 pounds. The volume of one container of the cargo is 10 cubic feet. You have 224 cubic feet available for stowage of the cargo. How many tons of cargo can you carry in the space available?

First find the stowage factor of the cargo: f = 22.4, therefore it takes 22.4 cubic feet to stow 1 ton of cargo.

As you have 224 cubic feet of space, you can stow 10 tons of cargo.

If a ship operator wishes to make maximum use of the space aboard his vessel, he must limit broken stowage, space aboard a vessel not occupied by cargo. Broken stowage can be caused by the shape of the area in which cargo is stowed. For instance, if you are attempting to stow square boxes in a circular compartment you are certainly going to have some broken stowage. Other causes of broken stowage include container shape, poor planning, and lack of skill on the part of the persons loading the vessel.

1.8 General Cargo Loading

When cargo is being loaded the ship's complement must exercise every precaution to insure that cargo does not block access to passageways, exits, and firefighting and lifesaving equipment. Cargo should also never be stowed on top of reach rods or sounding plugs, or any other devices that must be available for the safety of the vessel such as emergency fuel shutoff valves.

1.9 The Logbook

Most oil field companies provide the vessels on charter or owned by them with a company logbook. Included in the information required in these logbooks is a description of the cargo loaded and offloaded and any fuel and lubricants received or discharged by the vessel. This logbook must be kept up to date by the vessel's master and any damages or losses of cargo should also be entered along with a description of the circumstances.

Fig. 1.22

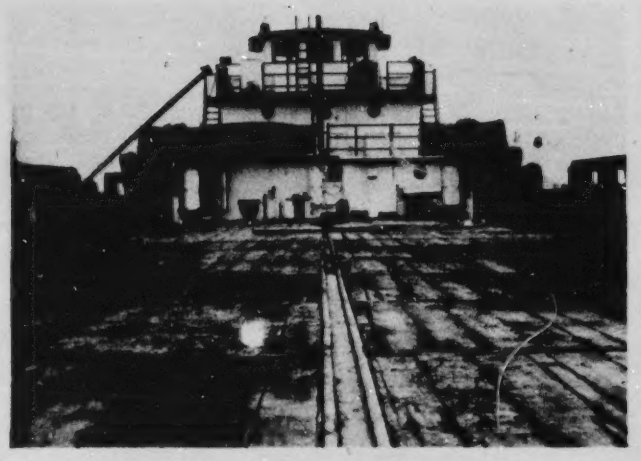
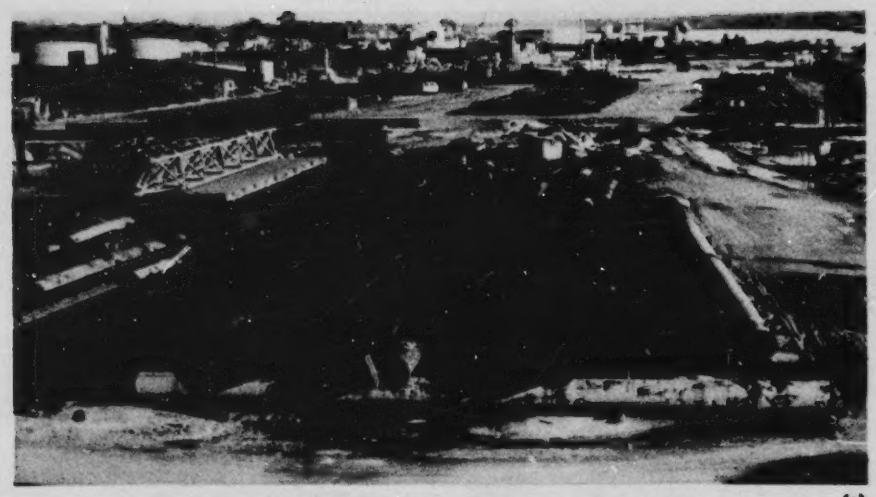


Fig. 1.1 The back deck area of an oilfield supply boat.



(a)

Fig. 1.2 Typical oilfield cargo terminal (a) above and (b) below.

(b)

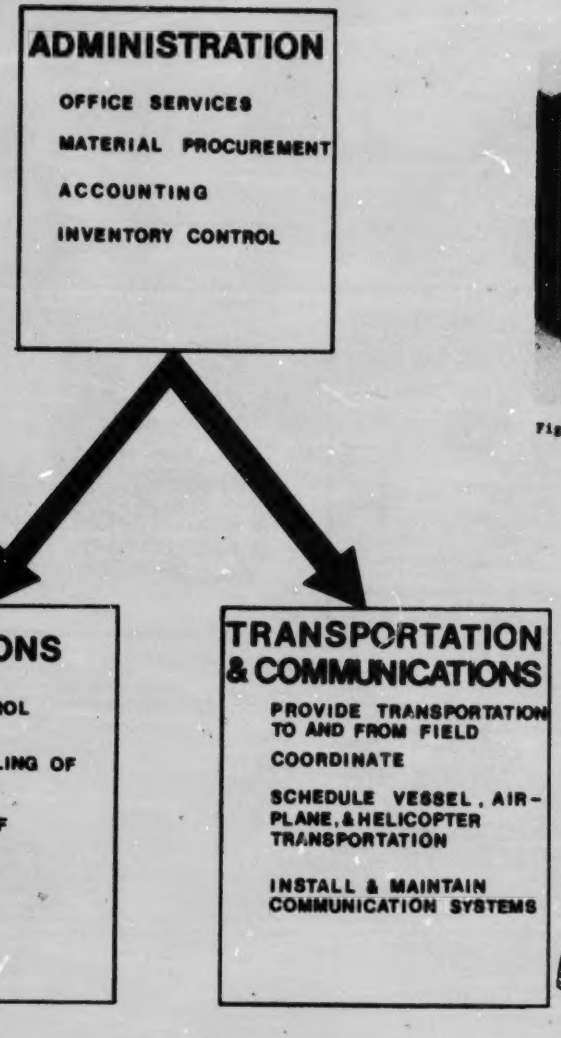


Fig. 1.3 The three major functions of an oilfield terminal.

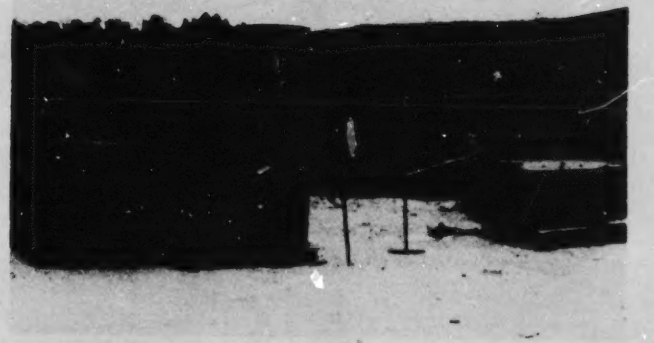
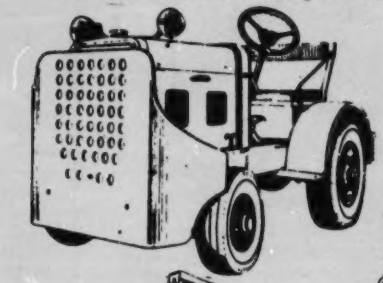


Fig. 1.4 Cargo is segregated according to destination.



1.5

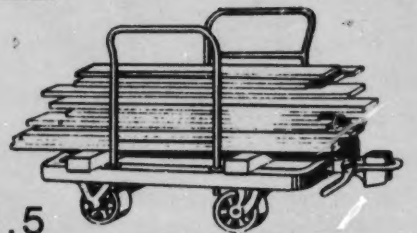
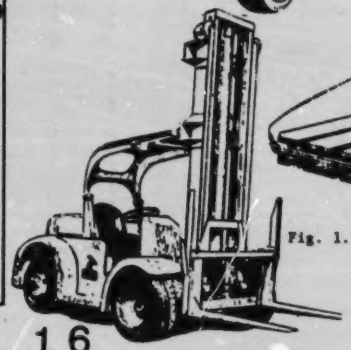
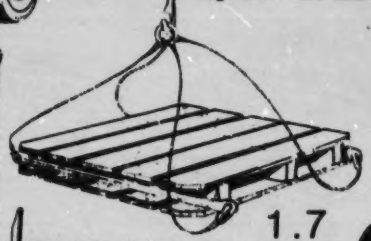


Fig. 1.5 The tractor-trailer combination.



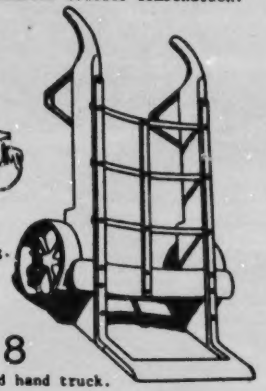
1.6

Fig. 1.6 Forklift truck.



1.7

Fig. 1.7 Pallet with pallet sling.



1.8

Fig. 1.8 Two-wheeled hand truck.

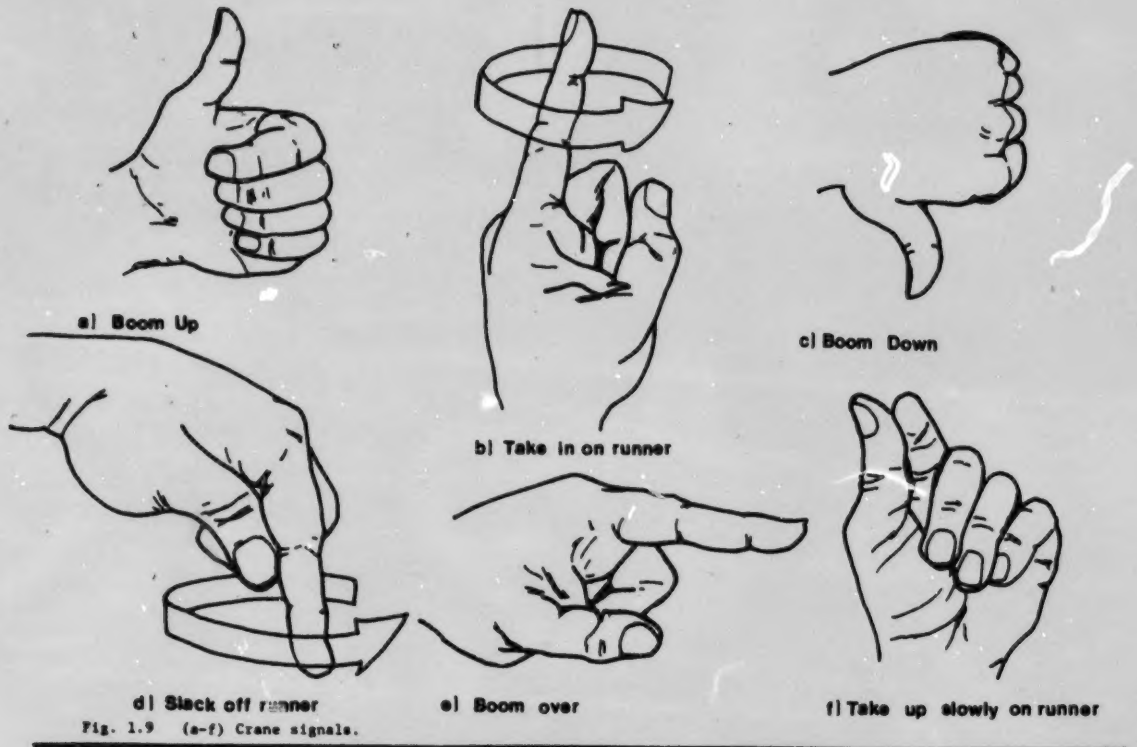


Fig. 1.9 (a-f) Crane signals.

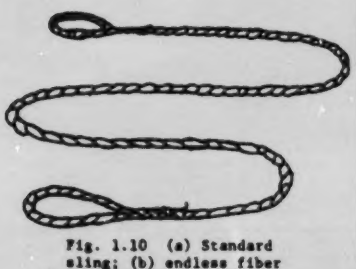
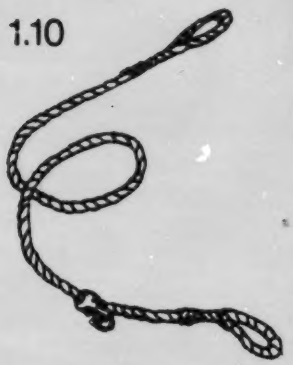


Fig. 1.10 (a) Standard sling; (b) endless fiber rope sling.

Fig. 1.11 Fiber rope snotter.



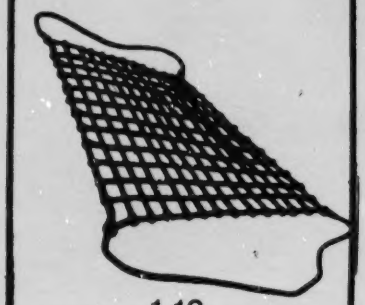


Fig. 1.12 Fiber rope net.

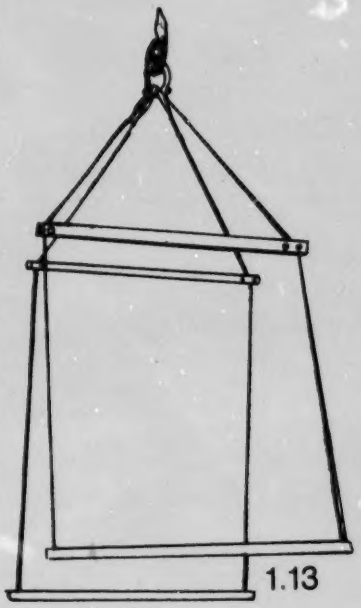


Fig. 1.13 Pallet sling.

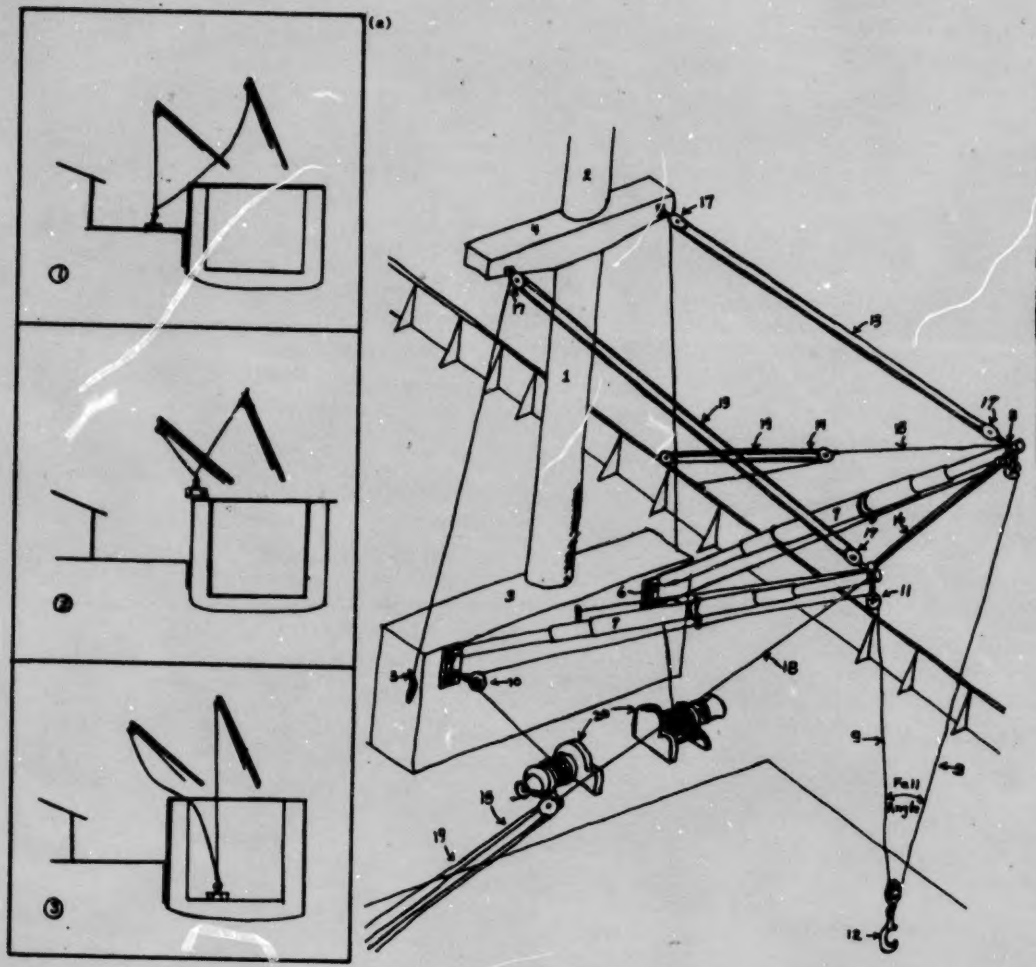


Fig. 1.15 (a) The married fall system--method of operation; (b) the married fall system--components.

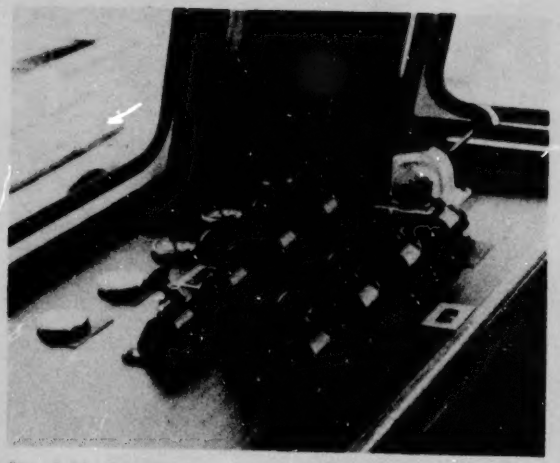
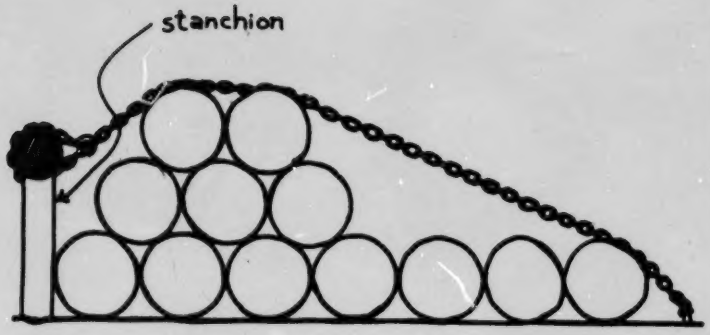
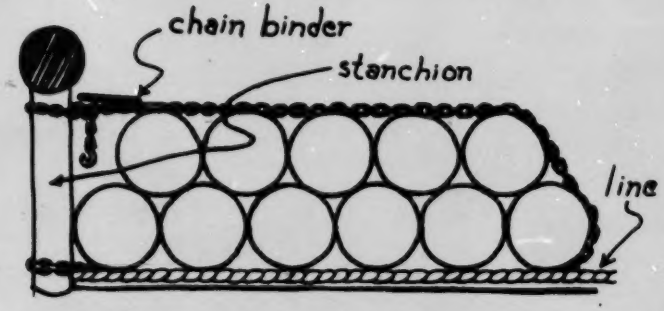


Fig. 1.14 Controls for the bulk mud and cement system.



(a) Improper stowage of pipe



(b) Proper stowage of pipe

Fig. 1.16 (a) Improper stowage of pipe; (b) proper stowage of pipe.

SR 129

Dangerous Cargo Manifest

DATE_____

M/V _____ or TUG _____ BARGE _____

LOAD OUT BY _____ AM.PM DATE _____

LOCATION _____ FIELD or BLOCK _____ RIG _____

W.O. _____ REQUESTED BY _____

MATERIALS TO BE ABOARD:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____
19. _____
20. _____
21. _____

USCG SPECIAL PERMITS 32–70

MATERIAL LISTED ON BOARD PROPERLY PLACED AND SECURED ON M/V _____
DATE _____ SIGNED _____
LOADED BY

PREPARED BY _____

Fig. 1.17 Dangerous cargo manifest.

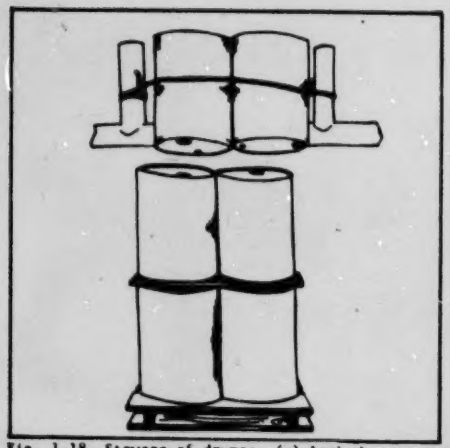


Fig. 1.18 Stowage of drums: (a) Lash drums securely to to pipe-rail; (b) use dunnage between tiers of drums.

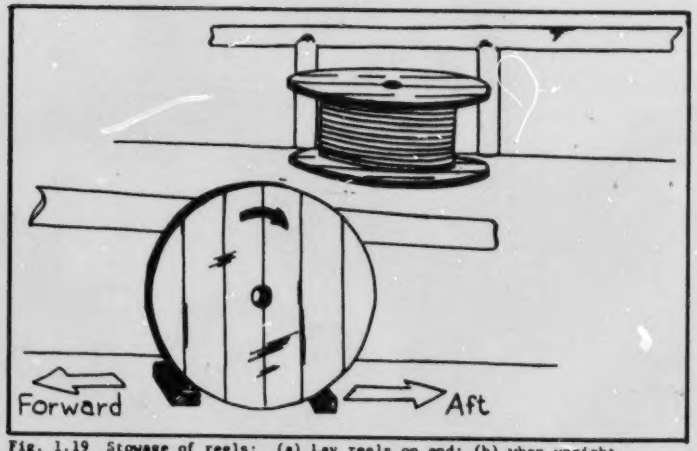


Fig. 1.19 Stowage of reels: (a) Lay reels on end; (b) when upright, position axis of reel athwartship and chock.

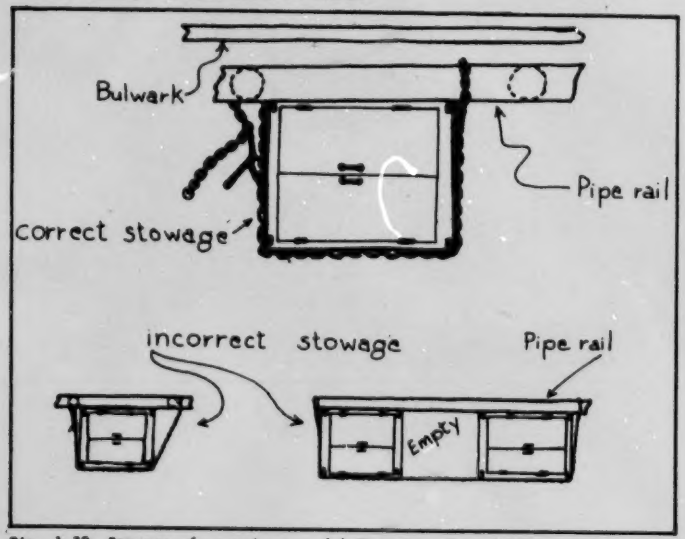
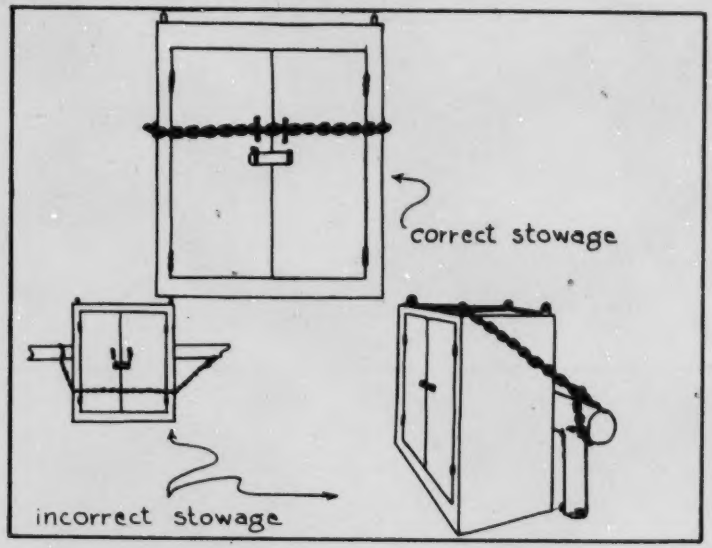


Fig. 1.20 Stowage of containers: (a) Top view of containers; (b) front and side views of containers.



(b)

DATE _____

M/V _____ or TUG _____ BARGE _____

LOAD OUT BY _____ AM. PM DATE _____

LOCATION _____ FIELD or BLOCK _____ RIG _____

W. O. _____ REQUESTED BY _____

MATERIALS TO BE ABOARD:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____
19. _____
20. _____
21. _____

MATERIAL LISTED ON BOARD PROPERLY PLACED AND SECURED ON M/V
DATE _____ SIGNED
LOADED BY

PREPARED BY _____

Fig. 1.21 Typical cargo manifest.

DAILY MASTER'S LOG
SHELL OIL COMPANY

* TUG
CREWBOAT
SUPPLY VESSEL

NAME M/V Seagreed DATE September 10 19 70

COMPANY NUMBER 01234

DEPARTURE TIME	DEPARTURE PLACE	ARRIVAL TIME	ARRIVAL PLACE	DESCRIPTION OF CARGO	NO PASS	REMARKS
0001	S.M.I. 27	0830	S.M.I. 583	Misc. Supplies	2	Pumped 500 gals diesel to Platform B
0900	S.M.I. 583	1130	S.M.I. 27	No Cargo	0	Pumped 700 gals diesel to S.M.I. 27
1300	S.M.I. 27	1500	Vermillion 190	Construction Supplies & Welding Machine	6	Pumped drinking water to Vermillion 190
1500	Vermillion 190	1900	Vermillion 190	Standby		Took on 2700 gals diesel from M/V Big Joe N.T.R. # 696901
1900	Vermillion 190	2130	S.M.I. 27	Welding Machine	6	
2130	S.M.I. 27	2400	S.M.I. 27	Stand By		

SAMPLE

OPERATING DATA

RUNNING TIME	9 HRS 30	MIN
STANDBY TIME	14 HRS 30	MIN
FUEL ON BOARD	5000	GALLONS
LUBE OIL ON BOARD	110	GALLONS
FUEL RECEIVED TODAY	2700	GALLONS
LUBE RECEIVED TODAY	0	GALLONS
FUEL OIL USED	475	GALLONS
LUBE OIL USED	5	GALLONS

ENGINE (YEARS, METER READING)

	O & M TODAY	O & M VESSEL TO DATE	DAILY RUN
PORT MAIN			
STBD MAIN			
PORT AUX			
STBD AUX			

	PORT	STANDARD
GEAR RATIO		

CREW ON BOARD

NAME	SOC SEC NO	LICENSE NO
Joe Smith	436-92-1107	136987
Bob Green	429-46-1010	None
Sam Small	435-96-8400	None

* OMIT WHAT IS NOT APPLICABLE
** OPTIONAL — OWNER'S DISCRETION

** FUEL OIL FILTERS

	HOURS SINCE CHANGE	HOURS RUN TODAY	TOTAL
MAIN ENG	428.5	10.5	439
AUX ENG	72	12	84

** LUBE OIL FILTERS

	HOURS SINCE CHANGE	HOURS RUN TODAY	TOTAL
MAIN ENG	428.5	10.5	439
AUX ENG	72	12	84

** LUBE OIL CHANGES

	HOURS SINCE CHANGE	HOURS RUN TODAY	TOTAL
MAIN ENG	428.5	10.5	439
AUX ENG	72	12	84

** REDUCTION GEAR PRESSURE	PORT	STARBOARD
	240	240

Joe Smith
MASTER

Fig. 1.22 Daily Master's Log.

2. MARINE TOWING

A tug is a compact, strongly built, well-powered work vessel especially designed and equipped for moving other waterborne vessels and objects.

Throughout the world of waterborne activities--marine transportation, construction, salvage, drilling, to name some of the more prominent ones--there are innumerable needs for vessels to provide propulsion power and control to move, or assist in moving, many and various types of floating objects. The vessels that perform this work are almost as varied in design, size, shape, power, and rigging as the jobs they are called upon to perform. They are called tugs or towboats, regardless of whether they are pushing or pulling, except the American river pushboat, which, though referred to as a towboat, is never called a tug.

Not only are tugs of special types among vessels, but the crews that man them are also often times special among members of the marine and sea-going fraternity. They are towboatmen, and, as such, must often be skilled and knowledgeable not only in the handling and operation of their own vessel, but also of the vessel entrusted to their care under tow.

This section is not intended to be a manual on towboat operation and seamanship; there are excellent publications and guides on towboat operation and seamanship for the working towboatman. Instead, this section will present a non-technical introduction and some insight into the world of towing, about the vessels and the men who work thereon and their respective functions, along with some of the requirements and demands that are placed on each.

Towboats generally work harbors, rivers/canals, and oceans. Boats that work in harbors and rivers are called inland tugs; ocean or deep-sea tugs work oceans. The vessels themselves in respect to design, equipment, and manning fit generally into those three categories although there are many instances in which certain boats are suitable for service in two, or perhaps all three of these areas. Also, while some boats are designed for one type of job only, others are suitable for a variety of jobs within their particular sphere of operation. Although the smallest boats are found in sheltered waters, size alone is not wholly indicative of a tug's work area because relatively small and large vessels are found in all areas.

We are concerned primarily with American tugs and towing, but it is interesting to note that boats and working methods differ from country to country. One can sometimes identify the nationality of a tug or at least the part of the world to which it belongs by its general character, shape, or silhouette. An American tug, for instance, usually has a longer deckhouse with the towing bitts or winch thus necessarily farther aft than its European counterpart--a result of the American custom of locating the crew's quarters entirely above the main deck rather than partially below. Dutch, German, and Japanese tugs may have features of hull shape, bow, or stack that are typical of each country.

2.1 General Types and Configurations of Tugs and Towboats

Modeled Hull Tugs. A tug is a work boat built to do a job, mainly that of providing power to propel or assist other vessels. As such, its layout or arrangement of space and compartments and its fittings are utilitarian. The traditional shape of towing vessels is the modeled hull with a pointed bow, flush deck, and rounded stern. Typically, the deckhouse extends from the forepart aft to about two-thirds the length along the main deck. The hull fines, or narrows, towards the bow, so the forward end of the house usually follows these lines and is rounded to give working room and passageway alongside the house and on the foredeck. The pilothouse is placed atop the maindeck structure at the forward end. It is several feet higher than the compartment abaft it so that windows in the after side may provide visibility astern from the pilothouse. The compartment abaft the pilothouse is the captain's quarters, so situated to give the captain quick and easy access to the pilothouse at all times. Often the mate shares this stateroom. The rest of this deck, which is the top of the main deckhouse, carries either lifeboats or rafts or both, and storage boxes or lockers for gear. Most tugs of this configuration have an auxiliary steering and engine control station at the after end of this boat deck to facilitate working the vessel under certain conditions. The stack is located on the centerline of this deck abaft the pilothouse structure and over the engineroom, with some twin-stack boats having two somewhat smaller stacks, one set to either side of the centerline.

Fig. 2.1

In the main deckhouse are crew's quarters and galley, and below the main deck are the engineroom, storerooms, machine shop, and tanks for fuel, water, and ballast. Along the main deck are arranged the fittings used in towing--the bitts, chocks, capstans, and winches. The towing bitts--large, heavy "H" bitts, or the towing winch if the boat is equipped with one--are on the main deck just abaft the house and on the centerline. This afterdeck, in most towing circumstances on this type tug, is the principal work area--the hawser or towing end.

Fig. 2.2

Fig. 2.3

Pushboats. On inland waters a large number of towboats are the pushboat type, especially on the Mississippi and in canals like the Intracoastal Waterway. The pushboat is box shaped with square bow and stern and parallel sides. Below water the hull is shaped or raked at the bow and stern to give it passage through the water. On the bow are two vertical push-knees that fit against the square ends of the barges that these pushboats are designed to handle. As they are designed to push rather than tow or otherwise use lines astern, their deck fittings do not always include a towing winch, although a substantial set of bitts is often provided on the stern. On inland waters you may see a towboat of modeled hull and shaped bow that has had its bow fitted with a framework and push-knees, thus converting it from a tug to a push-knee boat, or a combination of the two.

These pusher types are not seen in ocean towing (with one exception), or where wave action can be beyond the boat's ability to cope. The towboat is a separate hull and vessel apart from its tow, with correspondingly separate motions of roll and pitch in a seaway, and wave action could quickly break the connection lashings of wire or line between the boat and its tow.

The exception mentioned is a remarkable one, the offshore integrated tow. In an integrated tow the bow of the towboat fits securely into a slot in the stern of the barge being pushed to form a unit--the towboat being a "detachable" propulsion plant. Recently placed in service in U.S. waters is an integrated, catamaran hull pusher tug that can be rigidly connected to the stern of a tank barge by a pair of specially designed hydraulic locking devices, thus creating a unitized tank vessel of more than 600 feet overall length with a 14,000 hp propulsion plant and a design speed of 15 knots. The integrated tow concept, which makes tug and barge into a single unit has been around for some time on inland waters, but it is new to ocean work.

Coastal and Ocean Tugs. The conventional tug working in offshore coastal waters is the shaped bow, modeled hull type like the harbor tug, but in general a little larger with more horsepower and fuel capacity. Many of the larger harbor tugs work both inside and outside, and they are equipped with the generally heavier towing gear necessary to handle a tow under conditions that can be met on the open sea. Among coastal and ocean tugs is found the raised forecastle type of tug design, a design unsuitable for harbor work but found advantageous in open ocean and heavy seas. The tugs used for long ocean tows of large vessels, such as drilling vessels or distressed oceangoing ships, include some of the largest towing vessels afloat. They are virtually towing ships, beautiful in design and equipment, with powerful propulsion plants. We will

discuss these fascinating vessels and some of the features of their work a little further along.

Fenders--A Tug's "Trademark." Virtually every tug afloat, with the exception of the larger oceangoing tugs, is well fitted out with permanently hung, although replaceable, fenders of line, rubber, or tires. Indeed, the fender is probably the most common denominator of all the appearance features of tugs. They are also one of the most necessary, as a tug is constantly in contact with vessels it handles, and much damage would occur to both were it not for these protective fenders. Say the word "tug" and even the greenest of landlubbers pictures that squat, business-like old girl with the great whiskery fender dripping and drooping over her stem post and a brood of smaller fenders ranged along her sides. Most rope fenders were handmade by deckhands from old rope and hawsers. Today, used auto and truck tires are in wide use; they are easily available, tough and effective, and simple to use. Specially designed rubber fenders, half round or square in section, and capable of absorbing great shock forces, have proved highly efficient and are sometimes seen installed not only as a bow fender but in a run all around the hull, at about the deck line, as a rub rail.

2.2 Propulsion Plants

In the early days of towing, when the principle job of towing was to assist sailing vessels in and out of port, and for many years thereafter, towboats were powered by steam. But the advent of the diesel engine, with its many advantages--not the least of which is its instant availability for full-power service--changed that.

While there may be a few steam powered boats in service somewhere, we will consider that all towboats are diesel-powered vessels. Some few of these may be diesel-electric, a propulsion system wherein a diesel engine drives a generator that powers an electric motor that drives the shaft.

2.3 Types of Towing

We have said that there are in general three areas in which towboats work. Let's take a look at the types of towing usual in these areas.

Harbor Towing. We will include in this category all tugboats and work vessels that operate in a limited geographical area, usually within the confines of a particular port or harbor, and that do not normally make a trip or voyage from one locale to another.

Among the smallest are utility boats such as switcher tugs used to move and shift barges and small dredge tenders

used to move floating pipelines and derrick barges used in dredging operations. These boats have no living quarters aboard and are usually operated by two men--one to maneuver and a deckhand to handle lines. These boats are tied up until needed, at which time the men go aboard, start up, and get on with the job.

Somewhat larger boats, with crew living quarters aboard, will be found at such jobs as tending a fuel barge delivering bunkers to vessels at berth or anchor somewhere in the port. These and larger harbor tugs are normally in service 24 hours a day, with sufficient crew aboard for working a "six and six" watch basis of six hours on and six hours off, with a relief crew on time off ashore. One thing is traditional with tug crews; everyone is available to get the job done; even the cook is sometimes seen on deck helping in the handling of lines when necessary.

The largest of harbor tugs are those engaged in docking and undocking ships and otherwise assisting large vessels in maneuvering in confined harbor and channel waters. These tugs may be equipped with firefighting gear to double as fireboats in emergency, but any dockside or waterfront fire calls for tugs to move vessels or assist in controlling the fire.

The assisting of large ships in docking and undocking and in maneuvering in narrow channels is a tug practice that requires considerable skill and knowledge on the part of the tug captain and in turn on the part of his crew. In American ports the harbor pilot or docking pilot is aboard the ship and gives instructions to the tug about how and where to make up alongside, how many lines to use, and whether they be bow, breast, stern line, or what. Orders to the tug during maneuvering come from the pilot on the bridge of the vessel being handled--whether to push, pull, go ahead or astern, slow, half or full ahead, and the manner in which the tug responds greatly affects the whole operation.

The deck seamanship or line handling skill of the tug crew is important. Weights, forces, and strains on lines and gear can become excessive, and each man must follow prudent procedures and bear in mind safety for himself and his boat at all times. A large factor in safety in any tug work is the condition of the working gear, the wires, shackles and lines. Good maintenance is a part of good towboatmanship.

In any towing operation, the stability of the tug is important. It may be said that tugs are designed with a particular type of work in mind and have an inherent ability to perform it. Nevertheless, in any type of towing operation the situation can change very rapidly. One of the dangers to a tug handling a ship or large tow is getting a line or hawser

on which there is considerable strain or pull led off from the side or beam of the tug thus giving her an overturning moment or force that could capsize her. American crews call this tripping, and it can result from a number of things. The turning of a tug with a strain on a hawser while attempting to move the tow in a desired direction, the action of a vessel being assisted in using her own power and motion in such a way as to jeopardize the tug, or these things combined with current and wind place the tug in a dangerous position. At any rate a tug's crew must be prepared for any eventuality at any time during the course of a towing operation and must be capable of fast action and line handling to remedy the situation when necessary.

There is an air of readiness and service about a harbor-docking tug, both the vessel and crew, for service and assistance is their business and the vessel they are handling is their customer. Docking tugs usually have a particular pier or dock they use as a base where they tie up when not working that includes a dispatch office, a gear locker, and a machine shop. In all major American ports vessels are in and out and are docked and undocked around the clock, so the tugs must work the same hours. Sometimes some of the docking tugs are tied up for the night and the crews go home, but even so, provision is made for making a tug ready on short notice. A typical work schedule for a crewman on a harbor docking tug would be 24 hours on and 24 off, but this varies.

Towboats have built a reputation for their cooks, though sometimes it is the other way around, and plenty of good fare has become an expected way of life among most towboatmen. One can find some excellent bakers and cooks plying their trade aboard tugs.

Bay, River, and Canal Towing. Tugs in the bay, river, and canal towing trade are going someplace. The amount of traffic on our American inland waterways is staggering. Goods and materials of all types, petroleum and its products, lumber, ore, livestock, automobiles--almost anything can be found in this inland waterborne commerce. All of this moves in or on some type of barge, and those barges are handled by river or canal towboats, the boats getting their designation as one or the other principally as a result of where they spend most of their time.

In general, the terms "riverboat" and "riverboatman" refer to service on the Mississippi River system although other large navigable rivers such as the Hudson, Tennessee, and Sacramento have their own riverboat traffic.

Fig. 2.4

The Mississippi River towboat today is predominately the pushboat type, and the larger of these compare in size with the largest oceangoing tugs. In fact, because of a rectangular hull, minimum open deck requirement, and multideck house

built over practically the entire hull, the largest river towboats are larger in above-water volume than most ocean tugs.

Since the days of the first poled rafts the riverboatmen have been a separate breed among men who work aboard waterborne craft, and today's modern, powerful pushboats are operated by men with the same peculiar skills and talents as were their antecedents of paddlewheel days. This is because the river itself is the same. Currents, eddys, floods, shifting bottom, logs, trees, and flotsam make river navigation a practice requiring much skill and experience. Today's river tows may contain several dozen large barges carrying thousands of tons of cargo. Despite the tremendous power and maneuverability of the towboats, handling the boat and barges in the extreme weather, current, and traffic conditions encountered in the Mississippi, Missouri, and Ohio rivers calls for an equally tremendous amount of know-how. The most experienced of the Mississippi riverboat captains, mates, and pilots must surely be numbered among the best handlers of tows in the world.

Life on river and canal boats has, like in harbor towing, the advantage of being ashore frequently. Fresh provisions and fuel are obtainable at many convenient points and, despite adverse conditions of fog, weather, currents, and the like, the harbor, river, and canal towboatman doesn't have to prepare for and endure the severe motions of a vessel in heavy seas.

Canal boats today are largely the efficient pusher type towboat, and, together with their tow of barges ahead, they make for smaller editions of the larger river tows described. In both river and canal, multiple barge tows often see barges breasted alongside each other up to four across, depending on the channel width or regulated tow width along the route, with several such tiers lashed end to end. Considering the relatively confined space of a waterway such as the Intracoastal, some of the tows navigating it are rather large. Here, again, is a towing trade that requires experience and skill in boat and barge handling and good and prudent work on the part of the deckhands. A canal tow usually passes through locks where water levels differ, as at river-canal intersections, and while any number of tows can go into and through the locks "made up" and proceed on their way, some tows must be broken up in order to "lock through" and then made up on the other side. This operation, or just handling a tow in a congested situation while waiting with many other tows for a turn at the locks, calls for alertness and good towmanship on the part of all hands.

Crews in canal and riverboats travel from place to place with their boats, of course, and the work schedule varies with

the movement of the boats and the operating policy of the company. Some boats, on a steady run between certain terminal points, change crews at the end of a round trip. Other companies arrange crew changes at the end of a certain time period as closely as possible, wherever the boat is.

2.4 Make up and Handling of Tows--Inland

Like other facets of towing, there is some local variance in the manner in which tows are made up in order to suit certain towing jobs and local customs and conditions. There are three general ways for a towboat to make up to a tow:

1) to tow it astern on a hawser arrangement

2) to tow it alongside in a manner called breasted towing (Towboatmen also refer to a barge towed in this manner as being "on the hip.")

3) to push it ahead as with a pushboat

Hawser Towing. Hawser towing is accomplished by towing astern on a single hawser connected to the apex of a two-leg bridle, the other ends of the bridle legs made fast on the towed vessel. If the towed vessel is a square-end barge, the bridle should be connected on the forward corners. Or, using two hawsers, one should be made fast to each of the forward corners of the barge. This latter method gives better control of the barge. Hawser towing requires more room for maneuvering and control than breasted or push towing because the towed vessel must be led around by the tug. In confined or shallow waters the hawser must be kept as short as possible to gain directional control of the barge and to keep the hawser from chafing or dragging on the bottom in shallow water. When the tug must slow unexpectedly, however, there is danger of the tow carrying way more so than the tug and overrunning it, or of the tug necessarily altering course radically and suddenly to avoid collision and the barge running on ahead and tripping the tug. With increased traffic on all waters, hawser towing is not a preferred method except where there is plenty of room, as on broad rivers and bays, or when a second tug is used as a tail boat with a bow line on the stern of the tow to steer it and back on it if necessary, or made up alongside the tow in breasted fashion for the same purpose. A tug taking a tow to sea often puts the tow on a hawser inside, using a tail boat or boats for control until clear of the harbor, at which time the assist boats are released; then the tug only has to let out hawser and begin its tow.

Breasted Towing. Breasted towing is a practical way of handling a barge or other vessel or object with a tug. Unlike the hawser tow where there is no rigid connection between tug

and tow and differences in direction of travel and speed can occur, in breasted towing the towed vessel is made up securely and tightly alongside the tug so that power thrust ahead or astern and rudder response of the tug is transmitted directly and immediately to the towed vessel, the two being in actual contact. The usual lash-up for this tow calls for a line, usually a doubled bight of a line, the eye of which is on the tug's stem post, with the line running to a cleat or bitt on the barge and back to be turned and made fast to the stem post. This is called a slip line. Next we have a towing strap, a strong doubled line or wire, which leads aft from a bow bitt on the tug and applies the pull on the towed vessel. A similar line leading forward from the tug to the tow is a backing line for applying pull back on the barge to slow, stop, or go astern with it. A stern line is run over from the stern of the tug and this line, together with the bow line, is used to govern the angle at which the tug lays alongside the towed vessel. A tug has better steering control over a barge if the tug's bow is angled in slightly towards the tow. In some cases where a tug plans to shift from breasted tow to hawser tow upon reaching open water, the hawser is placed aboard the tow at the start and used as a stern line while breasting, the tow thus being moved stern-first. When ready to go on the hawser the tow is stopped. Deckhands go aboard the tow and throw off the towing strap and backing line, and the tug is held alongside with the bighted head line. With all hands aboard the tug, this head line is slackened, the eye taken off the stem post and "slipped" off the tow and handed aboard the tug. The tug slowly pulls away from alongside the tow, lets the tow drop astern, lets out hawser, and begins her tow.

Pushing. Pushing is relatively simple in rigging with a pushboat designed for the purpose. The pushing or towing knees are placed against the stern of a barge and lines or wires from the towboat are tightened by ratchets or winches to hold the tow securely against the push knees to give the towboat good control.

Multiple Barge Tows. Multiple barge tows are common with any of the three methods mentioned above in which case the several barges are lashed each to the other in the same manner as the towboat to the first barge. Two or more boats working together may be used in any of the foregoing ways.

There are many different methods of making couplings between barges. This is because there is a wide variety of rigging available, and boatmen constantly find new and better ways to use it. However, all companies that push barges use the same basic arrangement of fore and aft wires as shown in the diagram in Fig. 2.5.

Fig. 2.5 Figure 2.5 shows some of the most commonly used wires and their descriptive names. Barge A is being pushed by the towboat. A tow wire is any wire used to move a barge ahead. It is led from a cavel (or kevel) or timberhead on the towing vessel or barge aft to a cavel or timberhead on the towed barge or vessel. A backing wire is used to transmit astern motion to the towed vessel and is led forward from the towing vessel or barge to the barge being towed.

Stationary rigging is the term applied to lines, wires, ratchets, and winches aboard a vessel that are fixed in place and that are not ordinarily movable. Movable lines, wires, and the like are termed portable or running rigging.

Fig. 2.6 Some barges are equipped with stationary winches similar to those on the boat. Figure 2.6 shows a coupling using stationary winches. When using winches whether on the barge or on the boat, always make sure that the dog is down when tightening. The dog prevents the winch from running out under load. Always tighten the winch as the barges are coming together. Doing otherwise will provide you with some back-breaking exercise. If the captain is moving the barges apart and you have the power of the boat working against you, wait awhile and you can take up the slack with ease.

Fig. 2.7 Figure 2.7 shows a coupling made by the use of stationary ratchets. Take care of stationary ratchets by seeing that they are well oiled and that you have a straight lead to the ratchet to prevent bending the ratchet or its deck anchor. Ratchets can be a big timesaver when making a coupling.

Fig. 2.8 In multiple barge tows the pushboat is faced up to or against one string of barges. Figure 2.8 illustrates such a tow with the towboat faced up to the center or push string of barges. Strings of barges attached to either side of the push string are called drag strings. A towing line is led from a forward timberhead on the push barge to the after timberhead on the drag barge. Backing lines are led from forward timberheads on the drag barge to after timberheads on the towing barge. This is why timberheads are installed in sets of two. When pushing ahead the tow line takes effect and moves the drag barge ahead. When backing down the back line takes effect and the drag barge is moved astern.

Facing Up the Boat. Facing up the boat is the term used to describe the way in which the head of the towboat is placed against the end of the barge. Figure 2.9 shows a towboat faced up to the tow. Most boats use winches for facing up. However, some use capstans for this function. Before placing a wire on a timberhead, always unfoul the timberhead by taking off any other lines. After the face wires are placed on the timberheads, the lines may then again be made fast on top of

Fig. 2.9

the face wires. This allows a drag barge to be turned loose without breaking the coupling between boat and push barge.

Jockey wires are used to prevent the boat from sliding when the rudder is put hardover. These jockey wires also serve as a safety device to prevent the boat from tripping if one of the face wires should break. To prevent the boat from steering out of the tow, most large towboats require backing wires that lead from the barge to the stern of the boat.

Fig. 2.10

Figure 2.10 illustrates a towboat faced up to the middle of two barges. This practice is known as splitting on the heads. Face wires hold the boat securely to the tow and enable the boat to steer the tow.

While there are certain basics of handling common to all instances where a towboat makes up to a tow and moves it from one place to another, each tow is usually different from others in some manner. Different towboats, though basically of the same design, handle differently, and things such as size of the vessel or vessels being towed, whether they are loaded or light, and whether they respond more to current or wind, all affect the handling of a tow. A tank barge or vessel loaded with liquid has a cargo that is always in motion to some extent and is therefore apt to be more difficult to slow, stop, or otherwise control than a similar vessel loaded with a dry cargo. Twin screw boats made it easier to handle the boat alone while maneuvering to make up a tow and while handling the tow. The feel and skill necessary in tow handling comes from experience in working aboard tows, but one point for novice or veteran to remember is that it is usually easier to put way (motion) on to a tow than it is to take way off. In other words, be mindful always of speed under any circumstance because it is easier to increase speed a little than it is to slow down.

Two captains with tows in the Intracoastal Waterway were in radio contact and discussing a place where the canal intersected a stream. One tow had just passed this point and experienced a very strong cross current that had caused the captain some concern and almost broken his tow, and this captain was advising the other who had yet to pass the place, "you'd better make up your mind what you're going to do before you get there, because when you get there you don't have time anymore." There is a lot of tow handling wisdom in those words, namely, forethought. A smart and experienced towboatman, whether captain or deckhand, does well to think ahead.

2.5 General Duties of a Deckhand--Inland

Fig. 2.11

A towboat deckhand's duties consist of maintenance and operational work. Keeping the boat and her gear in good

condition and repair means chipping, painting, cleaning, splicing, lubricating and the like. Operational work is line handling mostly, and in some boats the deckhand takes a trick at the wheel. Line handling is extremely important in towing of all types, for after all, it is by virtue of the lines with which the tow is made up that the towboat is able to move the tow. Line handling can also be dangerous. The stresses and strains on wires, ropes, shackles, and the like are great, and a deckhand must always work with his wits about him. Prudent seamanship is based on common sense. The proper and established ways of handling various types of lines and of doing various jobs are willingly taught to a new hand by the older experienced hands. Deckhands on a towboat should never perform their duties carelessly.

Your duties while working on a towboat may consist of making up the tow, spotting, dropping, or switching barges at the docks, standing lookout, taking a turn at the wheel, maintaining the boat, and many other things.

Working on the Tow. While working on the tow, the mate is your immediate supervisor. He has been told by the captain what must be done and he is in full command on the tow.

Put forth your best efforts to learn how to lift, carry, and work with rigging in the proper manner. The basic skills in which you must become proficient include lassoing timberheads, fastening couplings, and splicing line, hard but satisfying work if done well.

Standing Lookout. You may be asked to stand lookout on the head barge of the tow. When operating in constricted waters this job is especially important and the safety of the tow, towboat, and crew are in your hands. Learn to use the proper hand signals while you are "riding the head." You are the pilot's second set of eyes.

Boat Maintenance. Take pride in riding a clean and sanitary boat. To keep the boat in good shape you will from time to time engage in painting and cleaning and in keeping up vessel equipment. Never take the hit and miss route of doing your job; be thorough in your work, and it will reflect well on you. Poor jobs come back to haunt you, as they may cause injuries to someone else.

Inspecting Equipment. Whenever you come on watch, always check barge compartments for leakage. If a pump is already in operation, check it periodically. Before going into a barge compartment make sure someone knows where you are going or is otherwise standing by in case you get into trouble. Check lines, wires, ratchets, and running lights, and keep an eye out for unsecured equipment. Use your ears also as in some instances sounds may alert you to something that is wrong.

When making a coupling make sure that you have all of the rigging necessary. This will save trips back to the boat. Take all the slack out of the wires and make sure that all couplings are cheater-bar tight before you leave the tow.

Lift and carry rigging properly. Use your legs to lift heavy objects, not your back. Even a boat's "toothpick" weighs as much as 10 pounds. Lifting properly prevents strains. For very heavy loads, get help. When carrying ratchets, carry them over your shoulder but make sure that you hook the pelican hook to its keeper to prevent it from flapping and hitting you in the head.

Rigging, no matter what it is, should be carried on the boatman's outboard shoulder--not on the inside. In case of slipping or falling suddenly, it is then easy to dump the equipment and obtain a quick handhold on the barge.

Figs. 2.12 to 2.16

Working with Line. Fiber rope aboard the boat is termed line. Observe the following rules when working with line:

1) Follow through when lassoing a timberhead. Practice at this skill as it is one of the most important. Never leave the tow to place the eye of the line over a dolphin or timberhead on the dock. The barge may move away, leaving you on the dock. Then you are of absolutely no use to the captain or the tow.

2) When you are through with a line, always coil it or fake it down as desired so that it is out of the way and ready for its next use.

3) Never step on a line. The spring of the line may cause you to lose your balance and fall or pitch you overboard. In the case of lines with a strain on them, which are a good distance above the deck, keep away from them! If necessary to pass from one side of the line to the other, pass under the line. Straddling a line that is working from side to side is a dangerous practice.

4) When you are called upon to lasso a timberhead, get prepared ahead of time. Take the line to the side of the barge on which it will be needed. Make sure that the line is free to run out, but control the line so that you don't soak the slack in the water or lose the line completely. Never tie the bitter end of the line to your arm or leg or place your leg in a coil of line. You may end up in the water, seriously injured. Hold the eye of the line about a foot from the splice with the eye open in one hand. In the other, hold at least two coils of line to provide you with the slack you need when throwing the line.

5) Never make a line fast to damaged timberheads or other damaged deck fittings. Don't take chances. Even if no one gets hurt, you may pull the fitting loose from the deck. Report such defects immediately to the captain.

6) Keep lines out of liquids on deck. Some liquids carried on barges may be damaging to the line and, at any rate, line soaked in petroleum products is slippery and heavy. Keep your lines out of the water and dry wet lines. This is especially important in the winter. In freezing temperatures, a line just has to touch water and it will become stiff and useless in a short time. A few times chipping a frozen line loose from the deck and trying to use it will convince you of the importance of keeping lines out of the water in the winter-time.

Listed below are a number of different lines used on a tow and their uses:

Back line	Holding-down line. It is used in the same application as the towline but at aft end of barge.
Backing line	Used to keep barges from running ahead, when making up tow.
Breast line	Any line that pulls you straight in or square.
Check line	Checks forward motion when stopping of barge or boat is required.
Dropping out line	Used in dropping out loaded barges.
Face line	Secures barge to towboat.
Fore and aft line	Secures two barges end to end.
Handy line	Small line for general use.
Head line	Mooring line used in combination to hold fleet or barge in.
Jockey line	Lashing used to secure two barges side by side; lashed over heads in X fashion.
Lashing	Any short length of line used to secure two barges end to end or side by side.
Lead line	Small line--manila or sash cord used to measure depth of water.

Lock line	Holds barges during raising or lowering of water in lock.
Monkey line	Small hand line used on lock wall by lockman to throw down or bring up lock line.
Quarter line	Used to set boat out, where maneuverability is limited.
Side line	Lashing used to hold two barges side by side.
Spar line	Secures spar to deck.
Stern line	Long quartering line.
Tow line	Holding up line. Actually a lashing from forward head of one barge to aft head of barge alongside.
Spring line	Used in mooring, crossing one another; holding down and holding up lines.
Peg line	Used in locks to prevent barge movement.

7) Stay clear of lines fouled on rigging. It is also wise to stay clear of lines that are taut and impossible to unfoul. When a line has been poorly tied on a timberhead, stay away until the tension in the line has decreased because the line may part. Modern synthetic lines have a lot of stretch; upon parting, they snap back. Sometimes the only solution is to cut off a poorly tied hitch. To avoid fouling lines on timberheads, take enough turns before placing half hitches over the turns; the turns will take most of the strain.

8) Use the easy method of turning a line loose. The farther you are from a timberhead, the harder it is to turn the line loose. However, the best method to accomplish this is to gather enough slack and roll the line with a snap of your arm to flip the line off the timberhead. Toss the line up and over in as wide an arc as you can, as the roll diminishes with the distance it travels. If you fail to flip the line off the timberhead and it becomes too late to turn the line loose, or if the line isn't long enough, let it go. Don't fall in the water for the sake of retrieving a line.

2.6 Coastal and Ocean Towing

Any vessel can tow, given the right conditions; indeed, becalmed sailing ships were often towed by their own long boats. With the advent of mechanical power it became possible to tow vessels in adverse weather conditions. This posed many problems, and the solution of these problems created the modern towing vessel.

Until comparatively recent times, most towages were performed by established towing companies. Coastal tows were carried out by local companies with an intimate knowledge of their own coast and with their own towing arrangements to suit conditions. Commercial ocean tows were comparatively rare and were carried out by large salvage tugs which, because of their special equipment, made difficult tows better risks.

With the expansion of the offshore oil industry into more severe and distant areas than the original Gulf of Mexico operations, new problems were presented to the towing industry. Not only were long ocean voyages sometimes required, but the towing vessel, in the case of a drilling vessel, also had to position the drilling unit very precisely on a particular location in the open sea at the end of the voyage. In order to do this successfully the tugs needed to be both powerful and maneuverable. The towing companies were faced also with a sudden increase in demand as a result of large drilling units moving from their place of construction to their site of operation, perhaps half way around the world. This, with the advent of the ultra large bulk carrier and its special salvage problems, and the large concrete deep-sea storage and production structures, spurred the towing companies to develop more powerful tugs.

Outstanding in ocean towing today are Dutch and German salvage tugs ranging up to about 250 feet in length and from 11,000 to 22,000 ihp. These two nations with Great Britain have for years been leaders in world-wide salvage operations and consequently deep-sea towing. With the exception of one salvage and marine construction company, Americans have not obtained prominence in this field comparable to some of the European companies. As opposed to these large salvage tugs stationed around the oceans of the world and available on the world market for general ocean towing, there are some fine, modern American tugs engaged in ocean towing principally for their owners who are marine construction and engineering companies. These tugs tow large barges of equipment, structures, and the like related to work in offshore petroleum areas, and they are sometimes chartered or engaged by other companies for specific ocean towing jobs, principally the moving of drilling units from one location to another. We speak here of vessels that are ocean tugs only, and not of

tug-supply vessels, which often perform short, or field, moves of drill units.

Ocean tugs must be capable of towing sizable vessels and objects in fully exposed conditions. While at sea under these more severe conditions maneuverability is not of major importance and a long hawser or towline, up to approximately 3,000 feet in length, is used, carried over the stern, to prevent the likelihood of a transverse or tripping pull. A lengthy hawser, with a considerable catenary, also does not tend to surge or come taut with strain as the towed vessel labors in heavy seas.

Stability. When an ocean tug has a tow on the hawser in confined waters such as may be the case when approaching a harbor, or perhaps has the problem of fairly precise positioning of a large drilling platform, she must be maneuverable under fully exposed conditions. In order to achieve this it becomes necessary for the towing vessel to shorten the towline and allow it freedom of movement in a transverse direction. It is during such maneuvers that an adequate reserve of stability is necessary.

There are many methods of calculating the required initial stability of a towing vessel, one being to consider the forces that the towed vessel could exert on the towing vessel during rough weather. For instance, if a Beaufort force 8 gale was assumed (a condition frequently encountered by ocean tugs in many areas, and the maximum under which any maneuvering would take place) and the forces on a number of large drilling platforms and large ships were calculated, results would show values ranging up to approximately 200 tons at zero ahead speed.

During maneuvering it is possible that the towing vessel could become beam on to this force, which is in the region of twice the bollard pull of tugs doing this type of towing. (Bollard pull is the pull a towing vessel can achieve while pulling against a fixed non-floating object such as a bollard on the edge of a dock.) While it is accepted, of course, that experienced ocean tug masters are extremely unlikely to get themselves into such a dangerous position, it is interesting to note that a large number of the better tugs in ocean towing today could withstand such a condition with a reserve of stability. This is indicative then of the fact that ocean tug designers are making the vessels inherently safe. If engine or control system failure should occur, resulting in a similar condition, then experience would be a useful bonus, but not a necessity in preventing overturning.

Towing Arrangements. We are speaking here about the hawsers, pendants, shackles, wires, chains, bridles, and the

like by which a tug tows another vessel, and specifically about the manner in which they are arranged or made up.

Various towing companies have their own preferences as to the manner in which a tow should be made up and the gear used. One leading salvage and ocean towing company prefers to use a heavy 3 to 4 inch chain bridle, the two legs of which are shackled to a heavy oval towing ring, which has inner bracings to form three open sections within the ring. To the third section of this ring is shackled a chain pendant of equal size to the bridle and 200 to 300 feet long, and to this is connected the tug's towing hawser, which is a wire in excess of 2 1/2 inches diameter capable of being payed out to about 3,000 feet. This is a heavy arrangement, but the men who use it feel that the weight gives good protection against surge on the hawser during heavy weather.

Another large towing company usually uses heavy chain leading from the clench plates or fastenings on the tow where the bridle is attached and through the fairleads until just over the side and clear of the vessel. At this point wire bridle legs are attached to the chains and the outer ends of these to either a heavy shackle or a flounder plate. A flounder plate is a heavy steel plate used to join three line-ends together--in this case the two wire bridle legs and a wire pendant--and is triangular in shape with drilled holes to accept shackle pins for securing the three lines. A wire pendant about 200 feet long and of slightly less strength than either the bridle or the hawser wire is attached here. This wire pendant is called the fuse wire. It is the weakest part of the towing arrangement and will break before any other part, yet it allows easy re-connecting of the tow in the event that a bridle leg or the main hawser parted. To this fuse wire pendant is attached a nylon strap to absorb surging shock, and to this the main towing hawser. Hawsers are wire, and they are wound on a towing winch.

In all these towing arrangements a recovery wire, usually a 3/4 inch wire, is led from a winch on board the towed vessel to the apex of the bridle so that the bridle may be recovered on board in case of a towline's parting and the necessity to remake the tow.

In almost universal use now on vessels prepared for tow is a clench plate developed by a Dutch towing company and known as the Smit towing connection. A heavy oval pin that fits through a link of chain and is secured by heavy steel plates to the vessel's deck makes easy connections and releases.

There are various formulas for calculating the required size and strength of hawsers and towing arrangement gear for any given tow, but with the large salvage and towing companies

this is seldom necessary. Their policy is simple: keep the vessel rigged at all times with gear capable of handling any towing job that might arise, even if it is a little more than is needed at times.

Horsepower. Power of a tug is usually stated one of these ways:

ihp	Indicated horsepower at the cylinders
bhp	Horsepower developed at the shaft
shp	Shaft horsepower (same as bhp)

There is another way of considering horsepower that for a tug on a long ocean tow is the most important of all. To develop full rated horsepower a tug's engine must turn full revolutions, and this in turn means maximum consumption of fuel. Because of the voyage distance, distance between bunkering points, fuel capacity of the tug, and towing characteristics of the tow, a tug could run out of fuel before reaching her destination if she utilized all of her available power. The important horsepower then is ehp--effective horsepower, the power a tug can use on a continuing basis with allowance for heavy weather and reach her destination or next fueling port with a safe reserve of fuel.

Watches. On ocean tugs the watch routine is that of a deep-sea ship: three watches of four hours on and eight off. On coastal tugs on voyages of short duration the six on and six off is often the case. In inland towing the captain and mate often do most of the steering, whereas on ocean tugs the deckhands, or able seamen, act as quartermasters, and their regular duty while underway is a turn at the wheel.

2.7 Governmental Regulations Affecting Towing

Regulations of vessels are based in general on a tonnage scale with vessels of smaller tonnage subject to less stringent regulation. The construction, equipping, manning, and operation of vessels are regulated. The U.S. Coast Guard is the regulatory body responsible for enforcement of most statutory regulations affecting tugs. Since September 1, 1973, all commercial vessels of 26 feet or more in length engaged in or intended to engage in the service of towing must be under the actual direction and control of persons licensed by the Coast Guard. Upward to 100 gross tons towing vessels are in general exempt from Coast Guard inspection and manning requirements, although when on certain types of coastwise voyages these boats have certain requirements to meet concerning crew lists and hours of labor. Vessels over 100 gross tons are subject to inspection and manning requirements that involve licenses for some deck and engine officers and certificates of competency for crew members, and that place certain requirements on equipment and construction of the tug. Tugs are also subject to Federal Communications Commission regulations regarding

radio equipment, station licenses, and the like. These requirements also vary according to size of vessel and type of voyage.

Tugs, like all vessels, must comply with the Rules of the Road, Inland or International, and a working knowledge of these is important to the men working on tugs.

Certain regulations concerning draft, size of tow, speed, and traffic are set out by the U.S. Corps of Engineers on canals under their jurisdiction.

There are also regulations that prohibit foreign flag vessels from engaging in coastwise and local trade in U.S. waters. When a U.S. tug makes a foreign voyage there are clearance and signing on of crew procedures to follow.

Although laws and regulations affecting tugs and the towing trade are many and complex, the ones that most concern the men working on the boats are those with which they must comply regarding the manning, safety, and operation of their tug.

2.8 Tug Nomenclature and Equipment

Fig. 2.17 In Figure 2.17 shows a typical towboat with some of its equipment labeled. Various types of fixed and portable equipment is carried on towing vessels to permit the vessel to carry out its job.

Capstans: The capstan consists of a vertical revolving drum around which lines are wound. Electrically or pneumatically operated, it is used to heave in and pay out lines, to move the boat or barges, and to retrieve towlines.

Winches: Be very careful when learning how to operate this piece of equipment. Winches may be manually or electrically operated. If a wheel on the winch is used to take up on the line on the winch drum, make sure that you do not foul your arm between the spokes of the wheel. This is a sure way to get a broken arm if the dog should slip with tension on the line. Some winches are lever operated much like the handle on a car jack. In this case, make sure that your chin is not in the way. If the dog should slip or the line surge, the handle can easily break an arm or a jaw. When using the winch, make sure that the line goes on the drum evenly, one turn next to the other, to prevent the line from jumping. When a shipmate is working with you to operate the winch, work carefully, keeping hands and fingers in mind.

Fig. 2.18 Ratchets: Ratchets are used to pull barge couplings tight. When kept in good condition, well-cleaned, and oiled, the ratchet will allow you to pull barges together with much less strain on your part.

Cheater bar: A cheater bar is used to increase leverage when tightening a ratchet. It is a long hollow pipe that is placed over the ratchet handle.

Toothpick: A toothpick is made of metal and is inserted in chain links in the coupling to prevent the ratchet, links, and wires from turning as you tighten the ratchet.

Fig. 2.19 Sledge: Sledges find various uses aboard a tow, but they are chiefly used to knock the keeper loose from the pelican hook when breaking a coupling.

Eye wire: An eye wire is the term used to describe any wire with an eye in one end. The other end of the wire usually is fitted with a socket to receive the chain links for attachment of the ratchet. It is extremely useful when making up a coupling.

Fig. 2.20 Jackstaff: A jackstaff is a long pole with a pendant attached to its upper end. It is placed at the center of the head of the tow to allow the pilot to ascertain the swing of the tow.

Pike pole: The pike pole is a long pole, sometimes painted with alternate red and white markings for use in measuring water depth, which is used for pulling in a line or a wire that is out of reach. It has a hook at one end.

Barge running lights: When we speak of barge running lights we mean the red port side light, the green starboard side light, and in the Gulf Intracoastal Waterway, the flashing amber light that is placed at the leading end of the tow. Some of these lights are permanently attached to the barge and are powered by the ship's light plant. Other side lights are battery powered. These battery powered lights are carried aboard the towing vessel and placed aboard the barges as required. It is very important that these lights be on at night and during other periods of restricted visibility to prevent the danger of colliding with another boat. Running lights should be checked periodically.

On tows containing flammable liquids, explosion proof lights are required by law.

Barge pumps: Small portable pumps become priority equipment when you have a leaking barge compartment. These pumps are also very useful for routine draining operations.

Pumps should be ready for immediate use at all times. Never refuel gasoline pumps while the pumps are running. When using electric pumps, all power cords should be connected to the pump and to each other before they are plugged into the

power source. Keep plugs dry to prevent shock and to avoid blowing fuses.

Do not let the pump run for long without liquid passing through it or you will damage it. Always shut the pump off immediately after you have pumped the compartment dry to prevent burning out the motor.

Timberheads: A timberhead, also called a bitt, is a vertical tie post used for making lines fast on deck.

Spool: The spool may be used for a fairlead, or the eye of a line may be placed over the spool when making a coupling.

Button: The button is a deck fitting found on boats but is also found on some lock walls. It is designed primarily for holding the eye of a line or a wire.

Chock: The chock is a heavy metal deck fitting with rounded edges through which lines are led.

2.9 Barge Designs

The three basic barge designs are shown in Figure 2.21.

Fig. 2.21

The hopper barge is designed for dry bulk cargo that doesn't require protection from the weather: gravel, steel, are examples. The tank barge is designed for all types of liquid cargo such as petroleum products, gas, molasses, and other liquids. The cover barge is for dry bulk cargoes that require protection from the weather such as paper, grain, and other commodities that could be damaged by exposure.

2.10 Safety

If you plan to work on a towing vessel, safety should be uppermost in your mind as you go about your job. Listed below are some of the more important safe practices that you must observe.

Figs. 2.22 to 2.35

1) Beware of slippery decks. Liquids spilled on deck, whether they be petroleum products or water frozen on deck, can be extremely slippery and hazardous. If possible, walk down the center of the tow and avoid the outside gunwales. If you must walk over slippery areas, make sure that you have a good handhold. Holding onto something doesn't mark you as a coward, but as a man who has common sense and who wants to be around tomorrow.

2) Wear a lifejacket. While on the tow, always wear your lifejacket. The history of towing is littered with the bodies of persons who walked onto a tow without a lifejacket never to be seen again.

3) Beware of ice. In the winter time ice and snow create a problem. Watch where you walk and remove ice and snow from frequently used areas as soon as possible.

4) Ladders. When using a ladder always face the ladder. It is good practice to grasp the rails or sides of the ladder rather than the rungs when climbing or descending because a weak rung may give way.

5) Changing spotlight bulbs. Before changing spotlight bulbs make sure that power to the light is off, and that the pilot knows what you are about so that he does not turn or move the light when you least expect it. If the light is located in a high exposed location such as the top of the pilot house, beware of sudden gusts of wind that may cause you to lose your footing.

6) Shoes. When working on a tow, steel-toed shoes are recommended to prevent painful foot injuries. Your shoes should also have a good gripping surface on the bottom.

7) Gloves. Wear gloves as you go about your work, especially when handling wires and line. Fishhooks in a wire can rip and tear your flesh; rapidly surging lines can burn your hands. It is a good practice to carry an extra pair of gloves aboard.

8) Caps. The billed cap is a favorite in towing circles. Besides preventing sunstroke on hot days, the bill will also shield your eyes when working around lights at night.

9) Flashlights. At night always carry your flashlight with you when on the tow. Coast Guard approved sparkproof flashlights should always be used.

10) Never walk the notch. The notch (opening) is any place in the tow where barge headlogs do not meet or barges are not even with each other.

11) Use extreme caution when walking the tow at night. When walking on the tow at night always make sure that you carry your flashlight with you. Never walk out on the tow at night unless someone knows where you are going or is accompanying you. Know where you are stepping and watch out for lines and cables that may cause you to lose your footing. Let your eyes adjust to the arc lights and shadows before proceeding.

12) Never step on manhole covers. Stepping on one edge of a manhole cover may cause you to fall into the opening if the cover is not well secured. Always step over and not on manhole covers if possible.

13) Never toss rigging. Rigging when tossed carelessly upward or aside can fall back on you. It may also cause sparks and ignite the barge if it is loaded with a flammable product.

14) Never tighten ratchets outboard. Always tighten your ratchets inboard. This way, if sudden slack comes in the cable and catches you offbalance, you will fall onto the barge and not overboard into the water.

15) Don't be careless with your only pair of hands. Beware of gears and fishhooks that may catch your fingers or your gloves. Always take care to put lines on cavels and timberheads properly so that you do not lose your fingers. A sudden movement of the boat or barge may catch your fingers in a bight of line and crush them against the timberhead. Don't daydream and get caught with your fingers between the push-knees and the headlog of a barge.

16) Stay clear of working lines. Don't get caught between a line and an obstruction. Get on the clear side of the line.

17) Man overboard. You too may someday depend on someone following proper procedure if you fall overboard. The most important thing to remember is--don't panic! Throw the man a life ring or your own lifejacket to give him added support. Notify the pilothouse so that the the captain can disengage the engines. The wheelwash creates an undertow and the man may be sucked under. As soon as possible lower the yawl and pick the man up. You should be well versed in the techniques of artificial respiration if it is needed.

18) Watch the bump. If you see that the barge you are riding is about to bump something, grab a hand hold and alert others on the barge not in a position to see it coming, by hailing "watch the bump." In any case, whenever the tow is coming alongside the dock or the barge is passing through a narrow bridge where there is a possibility that the tow may glance off an obstruction--hold on. Don't stand there with your hands on your hips or sit on timberheads at the forward end of the barge.

2.11 Locking

Fig. 2.36 a,b

Without locks some rivers would not be available for commercial use. The diagram in Figure 2.37 illustrates how a lock works to control water level to permit a tow to pass.

While the tow is in the locks the locktender is the boss, and his instructions must be followed. The entire tow may be placed in the lock chamber at one time if size allows. The procedure whereby the tow is broken up into smaller units for

passage through the locks is known as double locking. Powerful pumps operate to pump water into or out of the lock chamber to raise or lower the water level.

Lock pumps create a great flow of water and cause some surging of the tow while it is in the locks. Undercurrents, eddies, and crosscurrents place the tow at the mercy of the water and the tow will usually surge no matter how tight you work your lines. Be on guard against this movement. Stay well inboard, if possible, so that if you do lose your balance you will fall on the barge and not into the water. Should you fall overboard, even if you don't drown you may be crushed between barges or between a barge and the lock wall.

Fig. 2.37 a,b

When the tow first enters the locks, make your line fast on the timberheads close to the lock wall. As you drop lower in the locks the line will ride up on the timberheads. To avoid fouling, move the line over to the outside timberheads. You will have to stay alert to prevent your line from fouling, jamming and breaking. Once the pumps are started they will not be stopped for you to unfoul or retrieve your line.

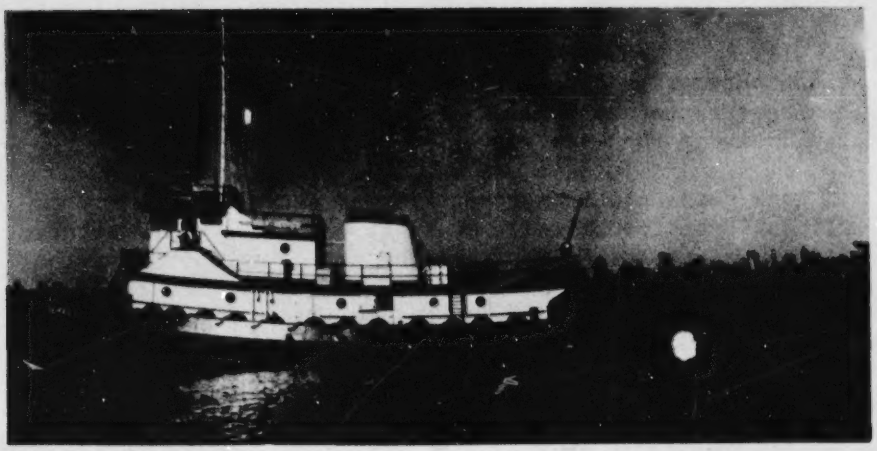


Fig. 2.1 Modeled hull tug.

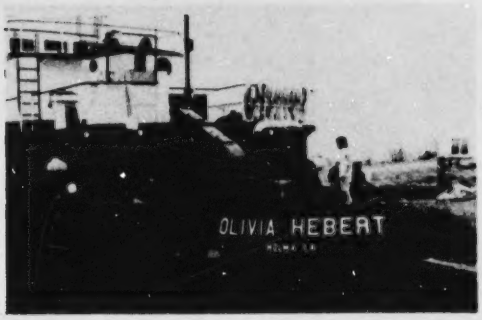


Fig. 2.2 Towing wench and H-bitts on back deck.

Fig. 2.3 Pushboat.

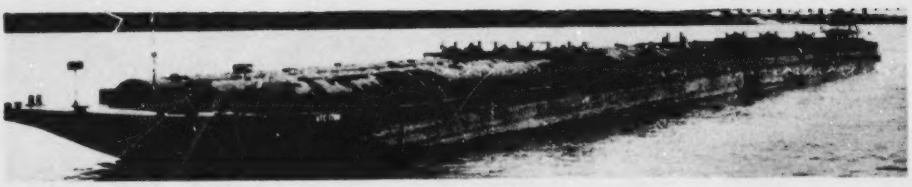


Fig. 2.4 Typical river tow.

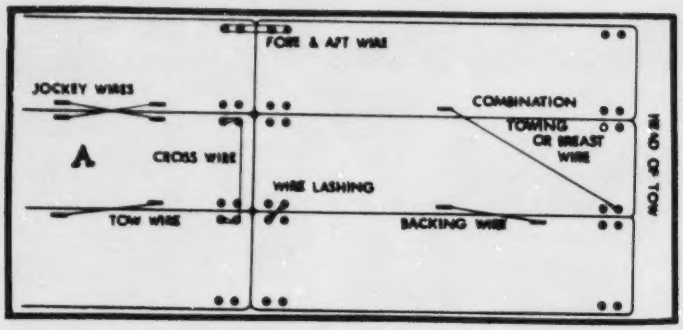


Fig. 2.5 Wires most commonly used and their descriptive names.

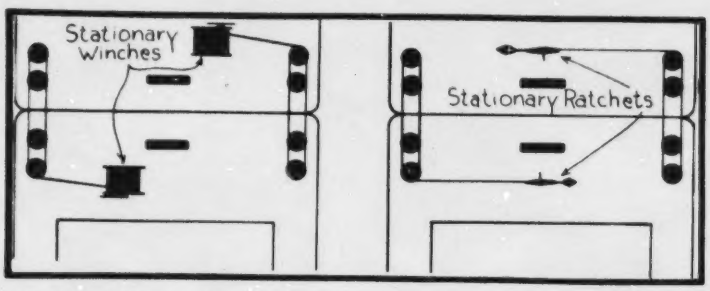


Fig. 2.6 Stationary rigging--winches. Fig. 2.7 Stationary rigging--ratchets.

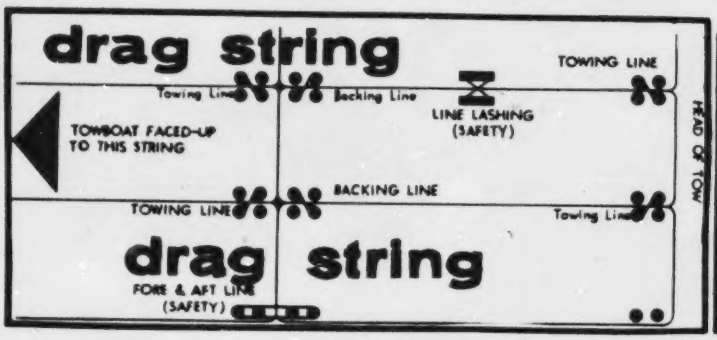


Fig. 2.8 Proper line use for towing "drag" strings.

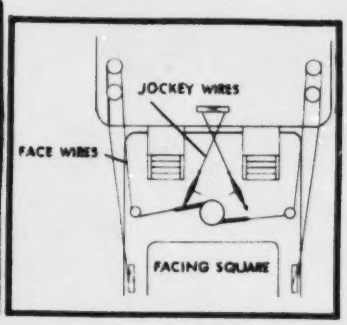


Fig. 2.9 Facing up the boat--facing square.

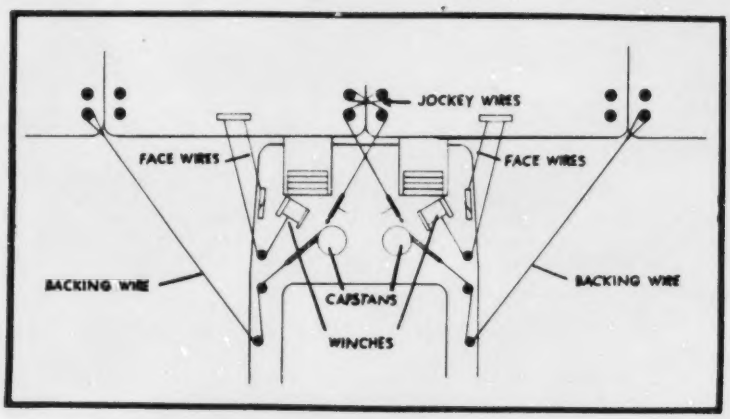


Fig. 2.10 Facing up the boat--splitting on the heads.

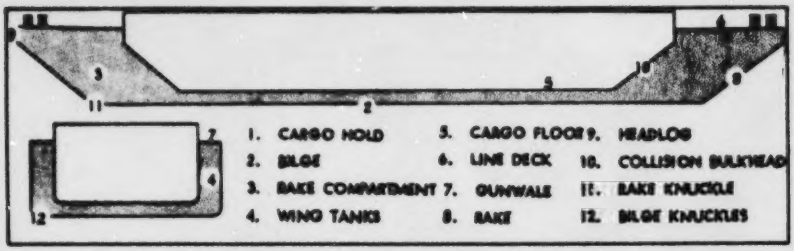


Fig. 2.11 Sections of common barge.

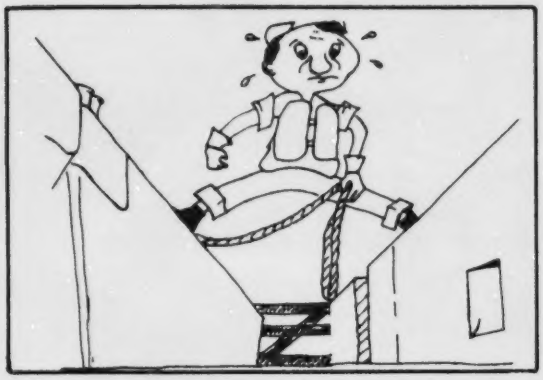


Fig. 2.12 Do not leave the tow to secure lines.

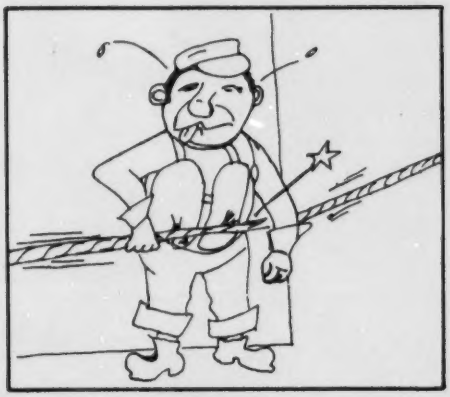


Fig. 2.13 Stay clear of working lines.

Fig. 2.14 Keep clear of lines with a strain on them.

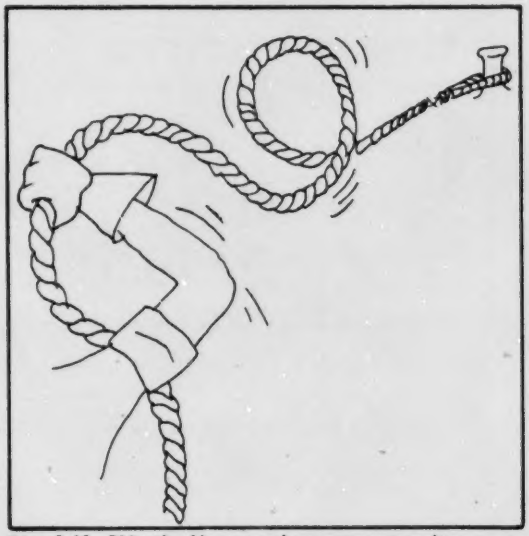


Fig. 2.15 Flip the line up and over to remove it from bitts.

Fig. 2.16 Let go of the line if necessary to avoid injury.

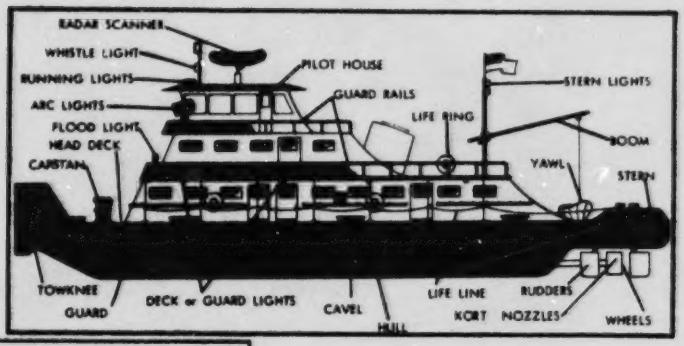


Fig. 2.17 Towboat nomenclature.

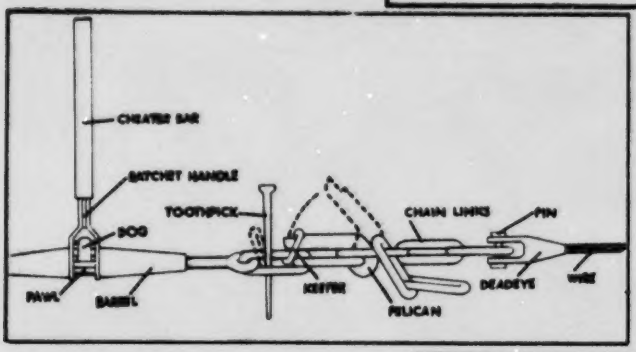


Fig. 2.18 Ratchet and securing arrangement.

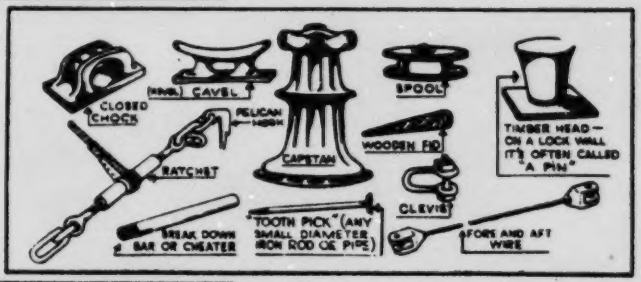


Fig. 2.19 Common names for equipment you will be using.

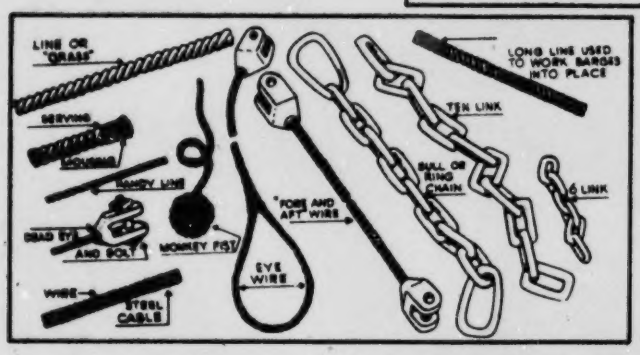


Fig. 2.20 Lines and rigging used on a tow.

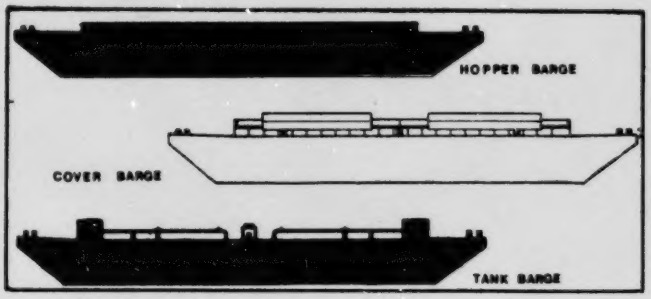


Fig. 2.21 The three basic barge designs.

Fig. 2.22 Beware of slippery decks.

Fig. 2.23 Beware of ice.

Fig. 2.24 Face the ladder.

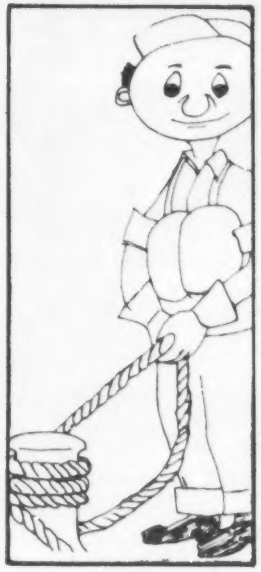


Fig. 2.25 Stand on the dry side.

Fig. 2.26 Never walk the notch.

Fig. 2.27 Use extreme caution when walking the tow at night.

Fig. 2.28 Never step on manhole covers.

Fig. 2.29 Never toss rigging.

Fig. 2.30 Never tighten ratchets outboard.

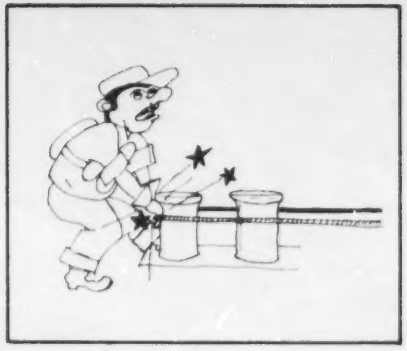


Fig. 2.31 Don't be careless with your only pair of hands.

Fig. 2.32 Take enough turns.

Fig. 2.33 In close quarters, hang on.

Fig. 2.34 Watch the bump!

Fig. 2.35 Watch your footing.

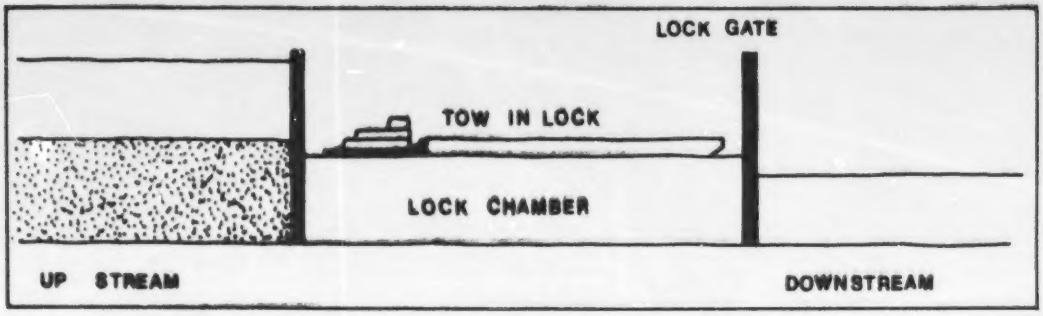


Fig. 2.36 Locking.

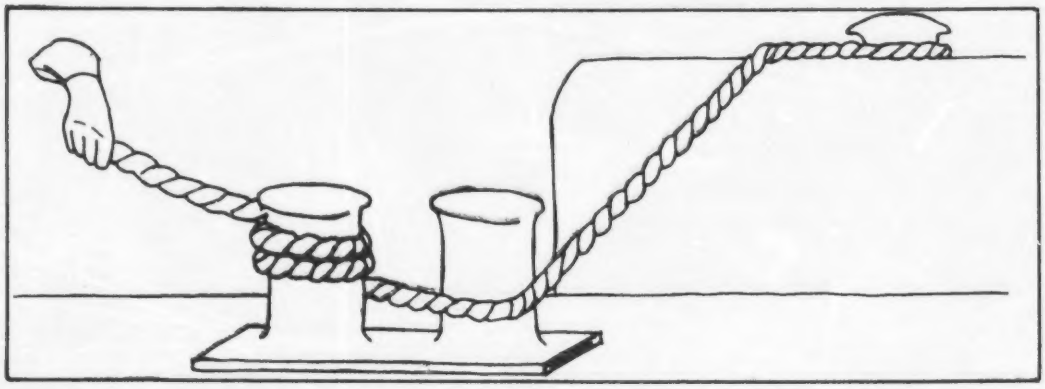
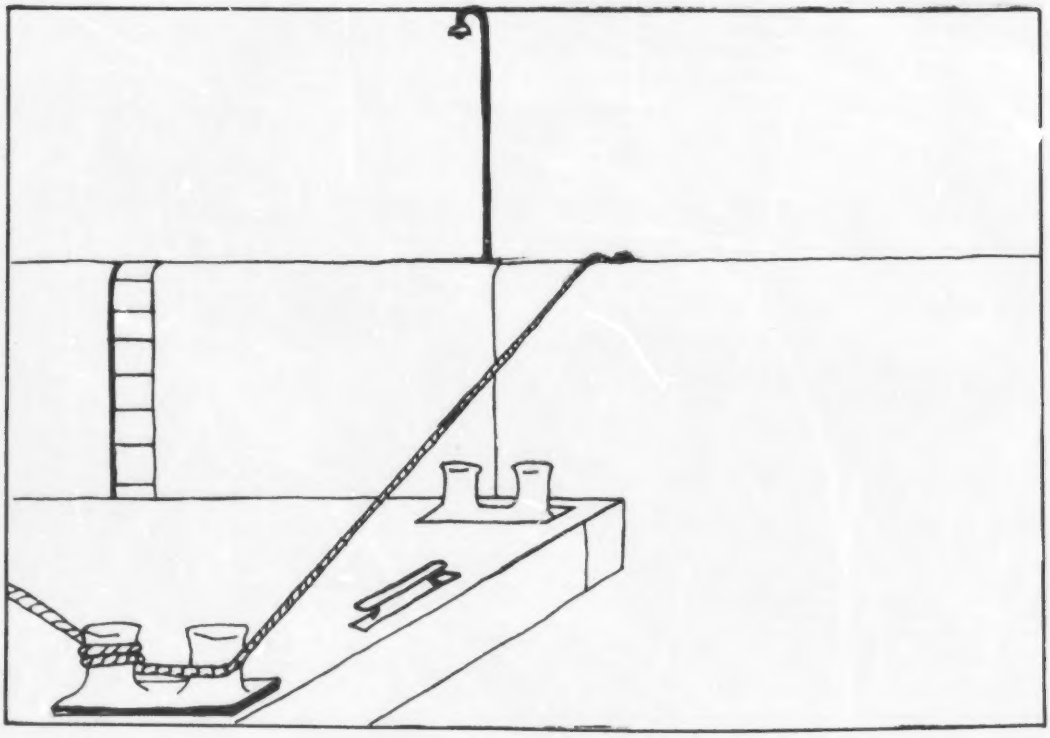


Fig. 2.37 (a,b) Lines must be adjusted and occasionally moved during locking.



3. ECOLOGY AND ENERGY

Two by-products of the economic and industrial expansion of the U.S. have been the consumption of our oil and natural gas deposits and the stress placed on our environment. We term that stress pollution. We Americans are faced with some critical choices as we attempt to work our way out of the cycle that involves energy demand, industrial need, consumer desire, and the preservation of a healthy environment for both human life and the life of nature's other creatures.

There is a growing emphasis upon ecology, the study of the relationship of organisms to their environments. Ecologists predict that unchecked pollution will stop the cycle of life on our planet. Though we have seldom thought of them as such, some of the most outspoken ecologists (or environmentalists) are the fishermen, shrimpers, and oystermen of the Louisiana Gulf Coast. These men have stood, often alone, in the fight to protect their fishing grounds. They were cautious about the development of offshore oil fields, and they were adamant about the further usage of DDT. These men were fighting to protect their means of making a living and their way of life. That is ecology.

Major pollution comes from industry and the automobile. Some of Louisiana's worst pollution has come from communities that drain sewage into streams, let fertilizer and pesticides drain into swamps, and litter the environment with plastic and aluminum containers that will neither rust nor dissolve back into earth. These are our personal contributions to a black and polluted environment. Our role in the problem is not limited to the automobile.

One form of industrial pollution that makes a great many news headlines is oil pollution. As a prospective seaman who more than likely will find employment in the offshore mineral and oil transportation or towing industry, oil pollution is the most important form of industrial pollution for you to learn about.

It was the threat of oil pollution that made the fishermen of the Gulf Coast cautious about the development of offshore oil. However, in the twenty-five years following the first well drilled in the Gulf of Mexico, the fishermen and the oil industry have gotten along well. In fact, as it turned out, the rigs and production platforms created artificial reefs that actually improved fishing. Incidences of pollution, caused by well blowouts, were relatively scattered. Gulf Coast fishermen came to accept the oil industry.

In this section we will cover the basic information about oil pollution that you will need to know as seamen or as tankermen.

3.1 The Critical Choices

First let us look at the overall state of the American environment and some of the critical choices that we believe America's citizens, including you and I, must make.

Governments in many states, and the federal government, have passed laws designed to protect the environment and to minimize pollution. One of the best known actions taken by government has been to require pollution-control devices to be attached to the engines of our automobiles. Internal-combustion engines do not completely burn the gasoline that fuels them. As the number of automobiles multiplied, so did the amount of pollutants leaked into the atmosphere. Finally, when smog (smoke and fog), engulfed many of our urban centers, doctors began to notice increased cases of respiratory diseases, and people realized that automobile emissions were harmful to health. It did not take as long for the automobile drivers to become aware of the effects of the catalytic-converters and other pollution-control equipment under their automobile's hood as it took them to recognize the effects of polluting emissions. Anyone who drives a newer automobile realizes that gas mileage on new cars is not as good as on the older models. When automobile manufacturers plead that pollution-control devices not only add $400 to the cost of the new car but also reduce engine efficiency, that is an appealing argument to eliminate pollution-control equipment. And now that there is an energy crunch and money is tight, that is an especially convincing argument that draws many consumers away from the side of the environment. But no one has suggested eliminating air conditioners, which are standard on most American-made autos, add about $400 to the cost of the car, and reduce engine efficiency. Here is a critical choice for America. Do we forego the luxury of air conditioning, thus saving our precious energy resources and reserving the environment for future generations? Or do we take the chance that our children may not be able to breathe the air in twenty or thirty years, so that we might perspire a little less?

Similarly, it is difficult for corporations to accept new regulations. Like individuals, industries are accustomed to the luxury of dumping wastes into lakes, streams, and rivers, as well as pouring them into the air. Until recently, no one complained that much about industrial pollution. We simply thought of it as an invasion of the aesthetics, not as a threat to our health. As we consumers continued to make increased production demands upon industry, more and bigger

factories had to be constructed; therefore, pollution increased. Today, even though there is adequate information available to the public to inform us of the environmental crisis, we continue to demand more productivity at stable prices. Increased productivity at stable prices in a time of diminished energy reserves may be an economic impossibility. Therefore, businessmen, realizing that production means energy consumption, will continue to argue for strip-mining of coal and use of high sulfur coals as fuel, which is a much greater polluter. It is likely that it will be easy for the consumer public to accept that argument. Again we are presented with a critical choice for Americans.

Any choice we make puts us in a bind. Perhaps a good rule in judging pleas for protection of our environment is this: Man did not create the environment, nor did man establish the balance of nature; but, man did create pollution. To those who accuse environmentalists of being merely doomsday prophets, we must remember the lesson of our current energy crisis, which is part of this vicious cycle in which our nation is involved. Twenty-five years ago experts warned that we would face energy-bankruptcy if Americans did not alter their usage of energy. We ignored the warnings of these experts, finding it easy to pass those men and women off as doomsday prophets. Simply, we found it too easy to accept the luxuries of these past twenty-five years and too difficult to admit the obvious; that someday the United States would have to pay for that luxury. Now experts are telling us that if we do not take definite steps to protect our environment, our descendants will inherit a cold and grim planet. It seems reasonable to suggest that we Americans should listen to those warnings. By cutting down on our own gluttony for luxury, we might solve two problems, preserving our environment and saving enough energy to live adequately, even if not too comfortably.

As future seamen, you must realize that a large part of the burden for protecting the bayous, lakes, streams, gulfs, and oceans will rest upon your shoulders; just as the burden rested upon the fishermen and other seamen of your father's and grandfather's generations. Your burden as seamen, and ecologists, will be especially important as you will probably be involved with the search for and production of oil on the Gulf and east coasts.

3.2 Oil Pollution

Increased production of oil offshore, and the importation of oil from other countries, has led to more oil spills and pollution. In 1970 there were 3,711 oil spills and other dangerous cargo discharges into the navigable waterways of our

country. A year later, that figure had more than doubled, and it has now reached an annual rate of about 10,000.

One of the most noticeable effects of the increased oil spills has been the change in public opinion toward the offshore mineral and oil industry and the related transportation and cargo operations.

In 1969, the Santa Barbara oil spill, which took place after a well blow-out six miles off the California coast, created a great furor. The well leaked tons of greasy crude oil over 800 square miles of the Pacific and covered 40 miles of beach.

The sight of pathetic sea birds struggling on the oil-soaked beaches turned many stomachs. Feathers matted to their bodies made it impossible for the birds to fly, and they died of exposure as the oil destroyed their insulation.

A spill of 119,000 tons of crude oil from the oil tanker Torrey Canyon in England in 1967, created a similar spectacle, killing off about 25,000 seabirds and wreaking havoc to other forms of marine life.

In January 1977 the Liberian-registered tanker Argo Merchant wrecked in the Atlantic off the coast of Nantucket, dumping almost all of its cargo of 7.6 million gallons of No. 6 industrial fuel oil into the water. Soon the slick measured 44 miles wide and 141 miles long and threatened economic ruin for New England's coast fishermen, as well as the area's multimillion-dollar summer tourist industry. While state and federal government officials watched movement of that slick, another Liberian-registered tanker in the Delaware River in Pennsylvania went aground spilling 134,000 gallons of oil and endangering waterfowl of all kinds.

Off the coast of Norway in April 1977 the oil well Bravo 14 blew, spewing crude oil into the North Sea. It created an oil slick 37 miles long and 32 miles wide. Then on December 24, the tanker Oswega-Peace in Connecticut's Thames River leaked 2,000 gallons of oil, polluting the riverbank for miles.

The Amoco Cadiz lost her steering off the Brittany coast of France on March 16, 1978. The ship drifted onto rocky shoals and emptied almost 69 million gallons of Arabian oil into the sea.

The hue and cry from the public, following the display of such catastrophes on the nation's television screens, provoked action from both the government and private sectors.

Studies within the scientific community have produced mixed results. Some scientists have concluded that oil spills create permanent damage to the fragile sea ecology. Other scientists indicate that the effects are not so permanent.

An environmental chemist studying fate and effects of oil on the marine environment said at an International Conference on Oil Pollution that an experimental oil spill study indicates no permanent damage to the environment after one year of monitoring.

Dr. Julia Sever Lytle, chief environmental chemist, Gulf Coast Research Laboratory, Ocean Springs, Miss., detailed the results of a study in which Louisiana crude oil was poured onto a shallow, intertidal marine estuarine pond. She said in presenting her paper, "Fate and Effects of Crude Oil on an Estuarine Pond," that the amount of oil poured onto the pond representated a heavy oil spill.

Dr. Lytle noted that the period of acute toxicity to the pond was short. She elaborated by saying that "marsh grasses recovered within six weeks; menhaden repopulated the shallow waters after six weeks; and shrimp, organisms which have a low tolerance level to crude oil, returned shortly after the spill."

In another presentation, "Persistence and Effects of Light Fuel Oil in Soil," Fred N. Swader, associate professor of Agronomy at Cornell University, said that "it would be desirable to obtain experimental data on the actual rate of assimilation of light refined oil under the conditions of soil and climate. Swader asserts that certain refined oils may be damaging to certain crop plants.

During a three-week period in 1970, an estimated 65,000 barrels of crude oil were discharged into the waters near the Mississippi River Delta from a Chevron platform. One year later, according to a research team, the oil had disappeared and no biological effects were found.

Dr. Clayton D. McAuliffe, senior research associate with Chevron, reviewed the test procedures and results of biological studies during a session of the fourth International Conference on Prevention and Control of Oil Pollution.

The fate of the oil shortly after the discharge probably provides a clue to the lack of long-term effects. McAuliffe reported that 25-30 percent of the oil evaporated during the first 24 hours, 10-20 percent was recovered from the water surface, less than 1 percent dissolved, and less than 1 percent was identified in the sediments within a 5-mile radius of

the platform. The remaining oil was dispersed, eaten by bacteria, or destroyed by sunlight.

One year later, the small amount of oil that had settled in the river bottom sediments was gone. Careful studies of the seabottom dwelling organisms, i.e., shrimp, crab, and fish, showed no effects from the spilled oil.

A marine life scientist said that marine organisms in San Francisco Bay have not suffered any lingering effects from a 1971 oil spill.

In January of that year, two oil tankers collided in thick fog under the Golden Gate Bridge, spilling 840,000 gallons of heavy fuel oil. Speaking before the fourth International Conference on Prevention and Control of Oil Pollution, Gordon L. Chan, College of Marin, Kentfield, Cal., said, "No lingering effects of the oil spill have been noted in any of the marine species."

From a study of data taken before and after the spill, Chan said, it was estimated that 4.2 to 7.5 million marine invertebrates, chiefly barnacles, were smothered by the oil.

"In subsequent observations, from 1972 to 1974" he added, "the sample counts of invertebrates has returned to, and in some cases surpassed, pre-oil-spill levels."

As for marine plants, Chan said, surf grass had suffered "some die-offs at the tips of the plants from the oil, but now their growth is as luxurious as ever," and in fact, "all the marine algae seem to be growing at pre-oil densities."

Snails, he said, currently appear to be "grazing in large numbers," and although about 50 percent of the mussel beds in the bay had been covered with the heavy oil, mussels survived with only a 2 percent loss. "The high survival rate," Chan noted, "is probably due to their effectiveness in keeping their shells closed during the time of oil coverage."

Oil can destroy the homes of wildlife that live near the water, ruin and discolor beaches and other recreational areas, and it can cause contamination of drinking water supplies of towns and cities. Additionally, though oil pollution is not the only form of pollution that affects our waterways, it is the most common, simply because our boats transfer oil from place to place. The accidental spillage of oil, gasoline, and other petroleum products is complicated by the dumping of oily wastes into the waters during bilge cleaning, deballasting, and tank washing. Oil pollution is especially irritating because it is released in the form of an oozing, black slick,

which is as repulsive to look at as it is dangerous to marine life.

Oil pollution remains basically the same, whether we are discussing heavy or light oil, or whether we are discussing major or minor oil spills. Slicks from heavy oil have the tendency to remain visible over a longer period of time, yet the results of the spillage of light oil, such as gasoline, are just as devastating. Though gasoline and other lighter oils evaporate or dissolve, many of the dissolved parts of light oil are poisonous to sea life, even if they are invisible. And, the spillages that we label as minor are cumulative; in other words, each time oil is spilled it tends to be drawn to oil already in the water, thus increasing the problem.

Much of the oil pollution is caused by human error. As the size of the tankers increases over the next few years, the chances for catastrophic oil accidents are greater. The Torrey Canyon spill cost the British $8 million to clean up. That is literally nothing compared to the kind of disaster that might occur on the newer supertankers that have cargo capacities three and four times larger than the Torrey Canyon.

It is conceivable, if not probable, that as a future seaman you will one day be involved in the efforts to contain and clean up an oil slick. There are several examples of such oil slicks having resulted from blown-out wells, though the best known slick was not in the Gulf, but at Santa Barbara, Calif., as mentioned earlier. It is necessary that you be familiar with the types of oil spill recovery and cleanup devices that have come about in the offshore mineral and oil industry. Also, you need to learn the types of laws and regulations that the government has passed to guard against the pollution of our waterways and the ocean environment. The laws and regulations, as they affect you as a future seaman, are passed along through the United States Coast Guard.

Oil Pollution Control: The Law. Pressure to pass laws to prevent water pollution have come from several sources. As we mentioned earlier in the section, fishermen and representatives of the seafood industries have been constantly aware of the dangers of polluting their fishing grounds. Fishermen, oystermen, and shrimpers have been instrumental in the development of anti-pollution regulations. Similarly, there have been pressures from waterfront property owners interested in the protection of their real estate investment. Citizen organizations, such as conservation groups, nature lovers, and hunting and fishing organizations, have played large roles in the passage of legislation.

The River and Harbor Act of 1899 was passed basically to

protect navigation. This law is still used today. Part of the law, termed the Refuse Act, made it illegal to dump garbage or waste into navigable waterways. Court cases arising from the dumping of oil into waters or onto the banks of waterways have often cited that 1899 statute.

As would be expected, the initial anti-pollution acts that concerned the rivers, lakes, streams, and coasts dealt with the dumping of human wastes and sewage. Increased knowledge led to more specific laws. For example, we know that changing the temperatures of water has a bad effect upon the growth of plants, fish, shellfish, and other marine life; in addition it makes it difficult for water to purify itself. This led to regulation of the industries that dumped hot water into streams.

The initial oil pollution law was passed in Congress under the title of the Oil Pollution Act of 1924. That law was passed to protect navigation from obstruction. Since 1924, there have been other oil pollution statutes, most notably, the Oil Pollution Act of 1961. The Oil Pollution Act of 1961 was a direct result of American participation in a 1954 treaty with other countries. The treaty placed operating limitations upon tank vessels, a move designed to impede the amount of oil getting into the sea. President Eisenhower signed the treaty, and the Congress, under President Kennedy, passed the law, which made the treaty applicable to U.S. vessels under U.S. law. The treaty and the act made it illegal for tank vessels to clean their tanks near shore and for other types of vessels to pump bilges or deballast bunker tanks near shore. The treaty and the law are updated periodically as needed.

A major piece of legislation was passed in 1948. That was the Water Pollution Act of 1948, passed primarily to deal with pollution of sewage and industrial waste. It was amended several times in following congressional sessions, but not until 1966 was it amended to include "oil." A major change in the Federal Water Pollution Act was made in 1970. The law prohibited discharging harmful amounts of oil into U.S. waters and required the reporting of any accidental discharge to the U.S. Coast Guard. The 1970 requirements covered the regulation of transfer operations, vessels, and terminals. Additionally, the laws required that anyone who discharged oil was responsible for its cleanup. The laws were so definitive that the Oil Pollution Act of 1924 was nullified.

Requirements for Tankerman Endorsement. There are a number of things that one must know in order to pass the certification tests for a tankerman endorsement. For example, the prospective tankerman must know the general arrangement of cargo tanks, suction and discharge pipelines and valves, cargo

Figs. 3.1 to 3.3

pumps, and cargo hose. You must know how to operate them and be trained in handling the kinds and grades of liquid cargo you will be required to handle. You must know how to use fire extinguishing equipment. Also, you must know the laws and regulations concerning water pollution.

Certification as a tankerman is a government-conferred endorsement, and that certification is a privilege that can be retracted by law. In other words, if you violate the laws concerning pollution control, or if through your neglect you cause an oil spill, subject to a hearing, you might have your certificate revoked. If you break the laws governing oil pollution, you subject your company to a possible fine and you could lose your job as well as your certification.

It is also possible that there are local ordinances passed by states, towns, or other governing bodies. For this reason, the seaman needs to be aware of any local law in the area where he finds work. It is impossible to discuss such laws in this section, of course, but at that time in the future when you are ready to seek permanent employment, it is important that you remember to ask about laws that have been passed by various local governing bodies (Table 3.1).

Oil spills must be reported to the Coast Guard. Individual companies may have rules about what to do if a spill occurs, and certainly such rules should be followed. But if your company does not have special rules, upon calling the Coast Guard you should tell them your name and the company name, where the spill occurred, what type of oil was spilled, and approximately how much. The Coast Guard can use such information to help determine cleanup procedures, and they will need to find out from you about the weather, tide, and sea conditions, as well as the cause of the spill. Still another reason for reporting this information is that it cannot be used in a court of law against you later, unless, of course, you make a false report. Though your company can be fined up to $5,000 for each offense for the spill, the company is subject to a fine of $10,000 for failure to report a spill.

Pollution Prevention Regulations. Pollution prevention regulations for vessel and oil transfer facilities (Title 33, Code of Federal Regulations, Parts 154, 155, and 156), were written by the Coast Guard. The Coast Guard based these regulations upon the Federal Water Pollution Control Act. The primary purpose of the Coast Guard developing these regulations was to prevent, where possible, accidental oil spills.

Part 154 deals with the large oil transfer facilities able to transfer oil to or from a vessel with a tank capacity of 250 barrels or more. Part 154 explains permit, equipment, and operational requirements.

Table 3.1. A summary of pollution laws and fines. (Taken from U.S. Coast Guard Booklet, Oil Pollution Control for Tankermen.)

"The River and Harbor Act of 1899 prohibits discharge of any refuse matter into any navigable waters of the United States, its tributaries, or banks (if the refuse is likely to wash into the waters). Violation of this act is a 'criminal action.' If convicted, a violator may be fined no less than $500 or no more than $2500, or be jailed for no less than 30 days or more than one year. Conviction also may lead to revoking or suspending the responsible person's license or certificate, if the discharge was done on purpose."

"The Oil Pollution Act of 1961 (as amended)." This act prohibits the discharge of oil or oily mixture within the prohibited zones. Prohibited zones are generally areas within 50 miles of shore, but may be extended to 100 miles. In this act, "oily mixture" means a mixture of one hundred parts or more of oil in one million parts of mixture. Penalties for violating this part of the act are the same as the 1899 Act.

(Another part of this act requires keeping records of transfer or discharge of oil or oily mixtures aboard tankers over 150 gross tons. Fines from $500 to $1000, or 6 months in prison, can be given for not keeping records or for entering false or misleading entries.)

"The Federal Water Pollution Control Act (as amended)." This act will affect most people involved with transfer and transportation of oil. This law is the basis of regulations dealing with oil transfer between vessels and shore facilities.

Section 311 of the act concerns oil pollution and liabilities. It states there will be no discharge of oil "into or upon the navigable waters of the United States, adjoining shorelines, or into or upon the waters of the contiguous zone." In this section, discharge means spilling, leaking, pumping, dumping, or putting into the waters of the contiguous zone." accident or on purpose. According to the law, the person in charge of a vessel shall immediately notify the Coast Guard as soon as he knows of any oil discharged. This is a very important part of the law. As soon as steps to stop the discharge have been taken, the Coast Guard must be notified by the fastest method (telephone or radio). Failure to notify the Coast Guard can lead to, upon conviction, a fine of $10,000 or a year in jail, or both. Owner or operator may be libel for payment of cleanup costs.

Part 155 deals with two basic areas: (1) vessel design and operation, and (2) oil transfer personnel, procedure, equipment, and records. The latter is the most important area for tankermen. According to Part 155, there must be on each vessel, one (or in some cases more than one) person designated as the "person in charge." On the tank barge, only a certified tankerman or licensed officer may be given the title of 'person in charge.' It is the responsibility of the person in charge to make certain that the oil transfer procedures are posted on the vessel, and that those procedures are followed carefully. Part of these regulations require that the transfer procedures must be posted where they can be easily seen or are readily available. The procedures that must be posted, under Title 33, Part 155, are listed in Table 3.2.

Table 3.2. Information on oil transfer that must be posted to comply with Title 33, Part 155. (Taken from U.S. Coast Guard booklet, Oil Pollution Control for Tankermen.)

1. A drawing of the piping, including the location of all valves, controls, pumps, vents, and overflows;
2. The number of people required for operation and duties of each person;
3. Procedure for operating the emergency shutdown system;
4. Any special procedures for either operation, containment of discharges on water, and reporting such discharges.

Part 156 of the regulation concerns the actual transfer operations and establishes many of the procedures required to be posted on the vessel. The regulations say "No person may transfer oil to or from a vessel unless" certain obligations are met. The obligations are listed in Table 3.3.

Part 156 also describes what is meant by proper connections in oil transfer systems. The regulations say that the material in joints must make a tight seal. If a coupling is a standard ANSI coupling at least four bolts (one in every other hole) must be used. If it is not a standard ANSI coupling, a bolt must be used in each hole. Bolts must be of the same size in each coupling and be evenly tightened. Bolts must not be strained or deteriorated. Unless authorized by the Coast Guard, no quick-connect coupling may be used.

Table 3.3. Conditions that must be met for compliance with Title 33, Part 156. (Taken from U.S. Coast Guard booklet, Oil Pollution Control for Tankermen.)

1. The vessel's moorings are strong enough to hold in all the expected weather conditions;
2. Hoses or arms are long enough to allow the vessel to move at its mooring without strain on the hose or arm;
3. Hoses are supported so that couplings have no strain on them;
4. All parts of the transfer system are lined up before beginning the transfer;
5. All other parts are blanked or shut off;
6. The transfer system is connected to a fixed piping system on the receiving end;
7. Overboard discharge or sea suction valves connected to the transfer system are sealed shut during oil transfer;
8. Transfer hoses are in good shape--no cuts, slashes, or soft spots;
9. Flange couplings are properly bolted;
10. Discharge containment equipment, such as drip pans, are in place;
11. Scuppers and drains are plugged;
12. Communications are available between the vessel and facility.
13. An emergency shutdown system is available;
14. Enough people to do the job are on duty;
15. The person in charge on the vessel is able to speak to the person in charge at the facility; (If there is a language difference, there must be translators available.)
16. The person in charge on the vessel and the person in charge at the facility held a meeting to discuss transfer operation before starting the transfer;
17. Both persons in charge agree to begin the transfer before it is started;
18. Both persons in charge are present during the transfer;
19. Required lighting is available at night.

The persons in charge must complete a Declaration of Inspection Certificate that says the transfer operation will meet the requirements of the regulations. The declaration must contain the name of the vessel and facility, the date, the time, and the signatures and titles of the persons in charge.

The person in charge must personally supervise critical operations (such as connecting, disconnecting, or topping off). He must give permission for flow to start in the transfer system and be continually available and nearby during the transfer operations. He must ensure that oil is not being pumped faster than the receiving facility can accommodate it, and the person in charge must shut down if oil from an unknown source is seen on the water.

Technological Advances, Discharge Containment, and Cleanup. In many parts of the world sinking and dispersing agents are used to "clean up" oil spills. Grains of sand, chalk, or carbon might be used to sink the oil to the bottom, or chemicals might be used to disperse the oil or cause it to dissolve into the waters, rather than to float on the surface. These methods are backwards, and generally they are not allowed in the United States, because dispersed or sunken oil is more harmful to sea life than oil on the surface. Also, this procedure is not allowed because oil on the surface can be cleaned up, while sunken or dispersed oil cannot. Additionally, some of the dispersing chemicals used to "clean up" are possibly more poisonous than the oil. (Dispersants may be used in some cases where the danger of fire is serious.)

The increased occurrences of oil spills helped to lead to the technological development, in this country, of some anti-pollution devices that are quite sophisticated. In the aftermath of the Santa Barbara spill, the Coast Guard began to seek ideas for such containment and cleanup devices. One specific area that the Coast Guard wanted developed was the concept of a lightweight high seas oil pollution control barrier. Under the usual procedure, several contracts were made with firms for concept development. The U.S. Coast Guard chose the concept presented by the Johns-Mansville Products Corporation, and along with several subcontractors, this group readied the first prototype barrier, one that was 1,000 feet long, for testing at sea, off the coast of North Carolina at Morehead City.

Under the direction of Mr. V. S. Bartoo and Dr. Jerome Milgram, the project developed well enough that the U.S. Coast Guard was convinced of the workability of the barrier and contracted the construction of 9,180 feet of barrier. Offshore Devices, Inc., received the contract and hired Mr. Bartoo, who had left his job with the Johns-Mansville Products Corporation, to supervise construction.

The barriers that are currently being produced are designed to be functional in five-foot seas and a one-knot current, with sufficient strength for ten-foot seas and three-knot currents.

Fig. 3.4 a,b

Offshore Devices, Inc., is producing a 4-foot high flexible curtain with rigid vertical struts on 6-foot centers (Fig. 3.4). When deployed, the barrier has a 21-inch freeboard on a 27-inch draft. The combination of rigid struts and flexible curtain sections provides outstanding sea-following ability.

Fig. 3.5 a-c

Another part of the U.S. Coast Guard's efforts to recover oil from major open ocean spills was the development of a skimmer device to pick up the oil once contained within the barrier. The Lockheed Missiles and Space Co., Inc., developed the Clean Sweep (Fig. 3.5), a transportable system that was tested by the U.S. Coast Guard at Morehead City, N.C., by the U.S. Environmental Protection Agency at Leonardo, N.J., and by the producers in their native California.

Specifications for the skimmer device, like that for the barrier, called for effectiveness in seas with average waves of five feet, random waves of ten feet, and two-knot currents with winds to twenty knots. By using an effective oil containment barrier and a rapid oil-recovery device inside the barrier, a major portion of the spilled oil can now be picked up before it can damage beaches, marine life, and water craft.

Fig. 3.6

The heart of the recovery unit, developed by Lockheed, is a paddlewheel disc drum, mounted crosswise between four inflatable pontoons that form a catamaran and support the aluminum hull. Within the hull is the diesel engine that powers the disc drum, the oil transfer pumps, the air pump to inflate the pontoons, and the electrical control system. For assured flotation, each inflated pontoon has a backup inner pontoon that is inflated simultaneously. As the disc drum revolves in the oil-water mix, oil adheres to the discs (while the free water runs off) and is carried past wipers that direct the oil to the hollow axle. Then the oil is pumped from the machine to storage containers. Analyses have shown that more than 90 percent of the recovered material is oil.

Another type of oil pollution fighter is an absorbent. A good example of the absorbent products is the Oilsorbent line offered by the 3-M Company. The absorbent devices are modern technological answers to the outdated absorbents such as straw and the like. These absorbent devices have proved to be more than useful in picking up after spills in areas of rough water. Often sorbents are used with booms.

There are six ways that absorbent materials might be deployed in an oil pickup mission.

One is the roll. Rolls of sorbent are easily laid along the shoreline and this is a recommended use in open areas on small spills.

Another way that sorbents can be used is the sweep, which is an extended length of sorbent incorporating a durable rope to enclose the material. This is a recommended application for any size rainbow sheen or other thin slick needing control as well as pickup.

A third type is the bulk square. These squares are placed directly upon the spilled oil and then retrieved. Due to their size, these bulk squares are the easiest form to reuse. This is a type of sorbent recommended for small spills in congested areas, shallow waters, and rocky shorelines.

The fourth type of sorbent is the particulate, which comes in compacted bales. These bales can be broken into chunks for manual placement, or blown through a mulcher. This is a type that is handy in open areas on large spills, where retrieval equipment is available.

Still another type is the pillow. Open mesh bags of pillow-shaped sorbent can be deployed directly over large quantities of light oil; but this method is most effective in small, confined areas.

The sixth type of sorbent is the sorbent boom, which is a sausage-shaped device linked together by built-in connectors to form a barrier to contain oil and to absorb it. Recommended for containment of small spills and for removal of larger spills of light oils, this device can also be used for long-term control of intermittent effluent discharges.

The retrieval of the aforementioned devices can be taken care of in several ways, depending upon the specific type of device employed. The roll, for example, may be grappled and pulled to a recovery point, as can the sheet. The sheet is also retrievable by using a pitchfork. The sweep can be pulled to the necessary recovery point by the sweep rope. The particulate is picked up by open impeller pumps or skimmers. The boom is towed and lifted by linkage ropes and containment mesh. After retrieval, these types of devices can be reused. Oil is removed by a wringer, squeeze roll, centrifuge, or solvent. From 50 to 90 percent of the oil may be removed from the sorbent, depending upon the effectiveness of the removal process.

The disposal of oil taken out of the sorbent, or the disposal of saturated sorbents, presents another problem. The ultimate in sorbent disposal is dissolving. However, when

dissolving is not possible, there can also be the more conventional types of disposal, incineration or open burning.

Fig. 3.7

There are other innovations in the anti-pollution fight. One is the catamaran skimmer, such as the 58-foot Marco Class III (Fig. 3.7), which belongs to the Marco Pollution Control Division of Seattle, Wash. The skimmer uses a filter belt system of removing oil from the surface of the water. Filter belt material is an open celled foam that is formed into a continuous conveyer. Oil clings to the millions of tiny strands while water flows through freely. Sorbents and oil soaked debris are carried up the belt and separated from the reclaimed oil. Trash is deposited into a trash bag, which, when full, can be stored on the aft deck of the vessel. A hydraulic deck crane enables the skimmer to lift large debris such as poles and trees from the water.

Fig. 3.8

The pneumatic vacuum system (Fig. 3.8), such as the one produced under the trade name Vac-U-Max Oil Skimming Systems, is also useful. These units are designed for the prompt handling of oil spills and for cleanup on a regular or emergency basis. This system operates entirely on high pressure air and requires no electric power. The units remove oil under hazardous conditions and can be adapted to perform other cleaning and fluid handling applications. The vacuum is created by a venturi power unit capable of moving two gallons per second. Models are available as complete units, as cover units to fit standard 55 gallon or oil drums, 275 gallon tanks, or special units for separating reusable material from disposable materials.

Fig. 3.9

One device used to separate oil from water following recovery in an oil spill is the oil mop and Rainbeaux filter (Fig. 3.9). This device is capable of processing an oily mixture from either shipboard or from dockside. The system is capable of removing emulsified oil from influent bilge water with results that meet the Environmental Protection Agency and Coast Guard standards.

Fig. 3.1 Tankerman making hose connection prior to transfer.

Fig. 3.3 Warning sign that must be posted aboard tank barges.

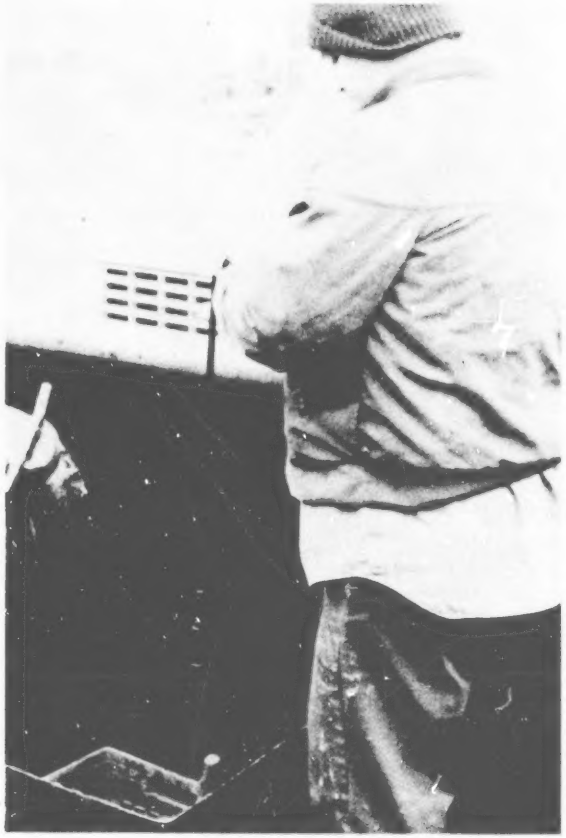
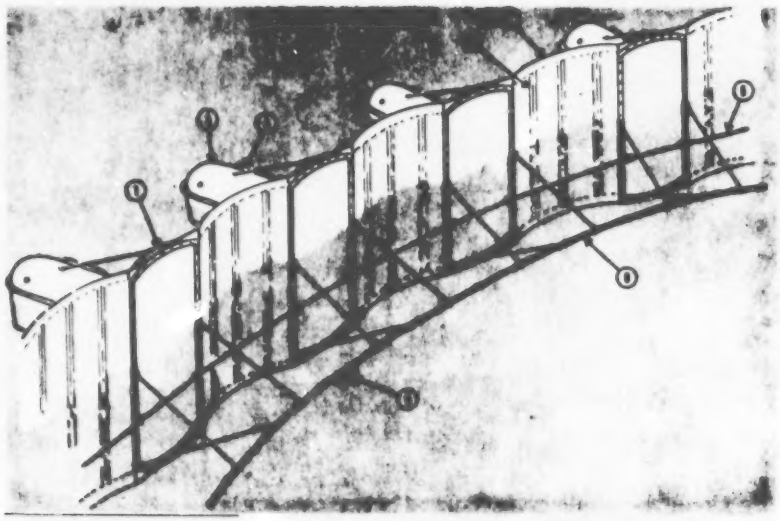
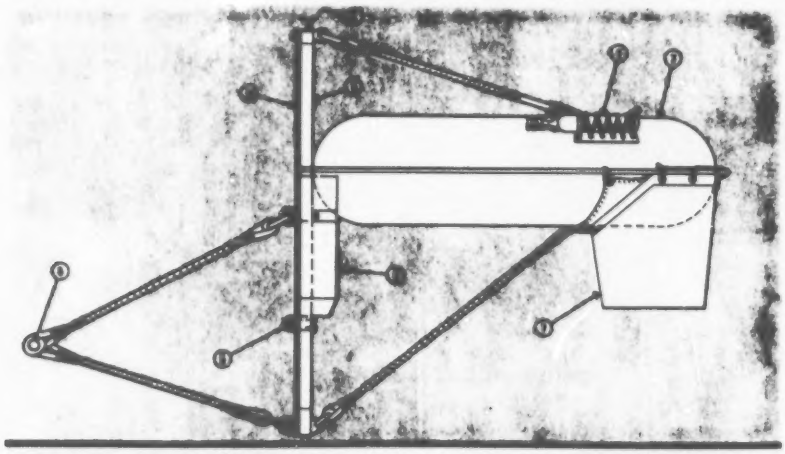


Fig. 3.2 Sounding tanks during fueling.



1 STRUT
2 CURTAIN
3 INFLATABLE FLOAT
4 CO_2 BOTTLE & VALVE
5 SLACK RETENTION LINE
6 MAIN TENSION LINE
7 DYNAMIC BUCKET BALLAST
8 FOAM FLOTATION
9 PICKUP LOOP
10 BATTEN POCKET with BATTEN

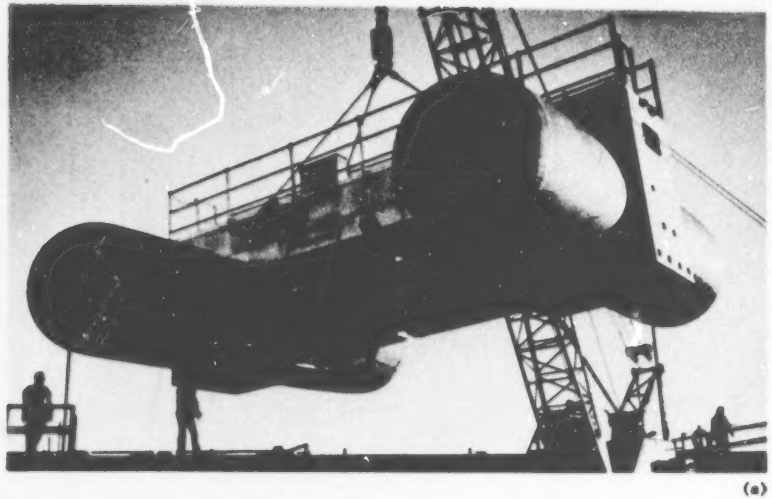
(a)



(b)

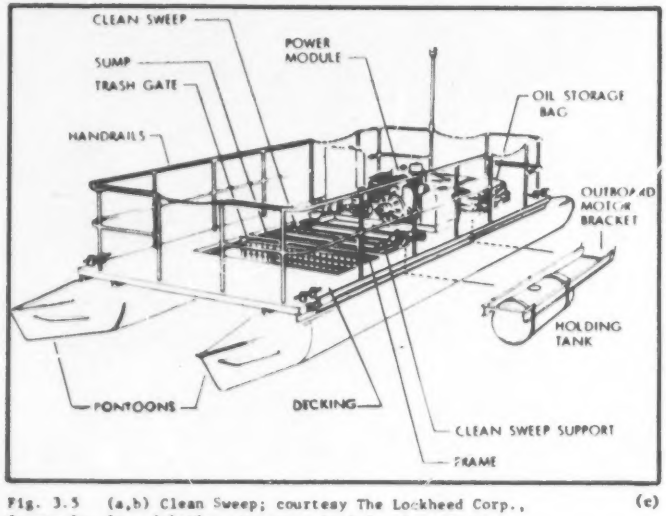
RECOMMENDED CONFIGURATION FOR OIL RECOVERY. SKIMMERS ARE LOCATED WHERE THE OIL DEPTH IS GREATEST THUS MAXIMIZING THE OIL RECOVERY RATE.

Fig. 3.4 (a) Offshore Devices barrier; (b) recommended configuration for oil recovery.



(a)

(b)



(c)

Fig. 3.5 (a,b) Clean Sweep; courtesy The Lockheed Corp., Sunnyvale, CA. (c) Clean Sweep--principle of operation.

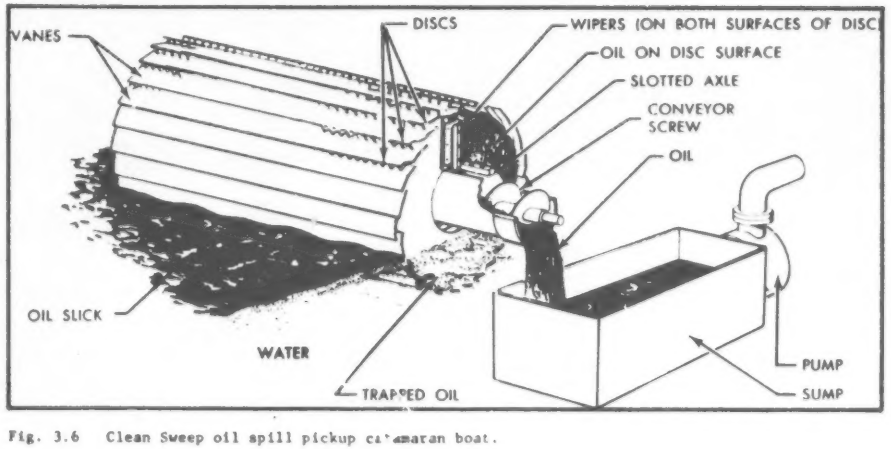


Fig. 3.6 Clean Sweep oil spill pickup catamaran boat.

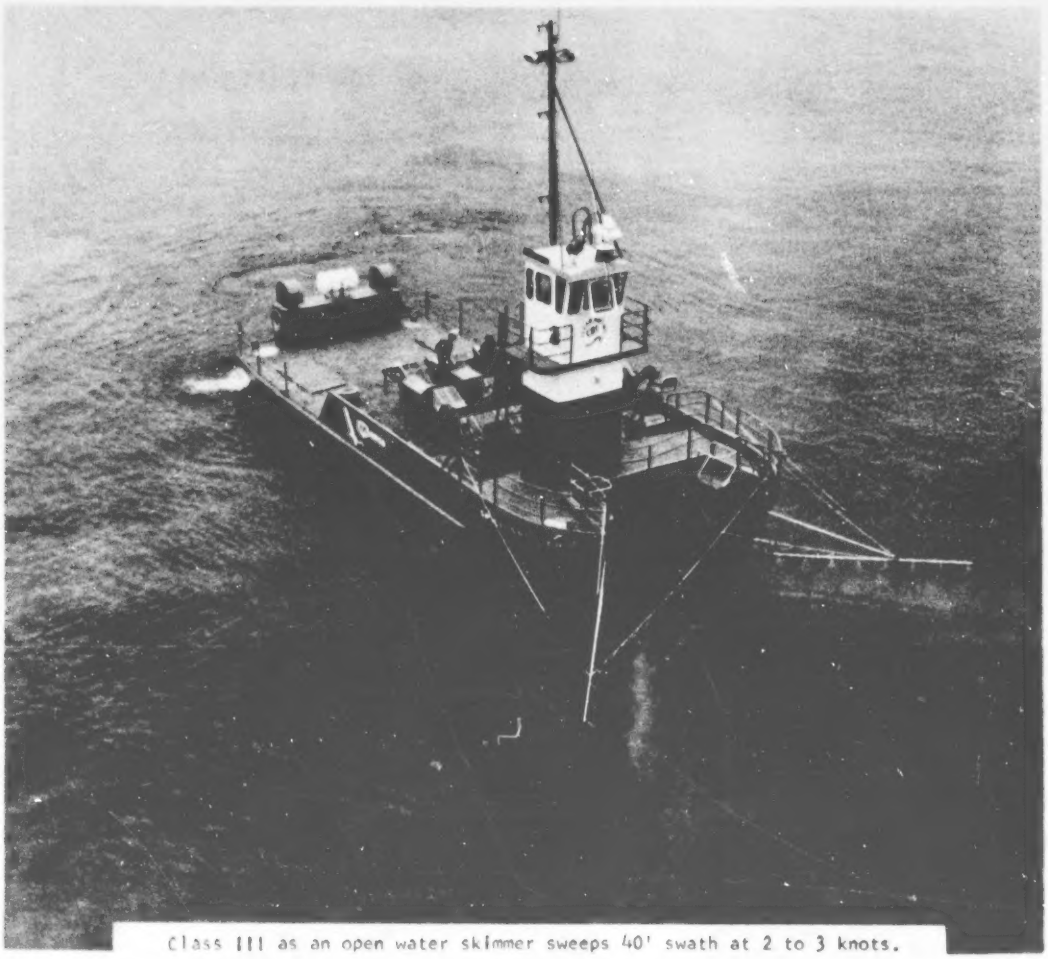


Fig. 3.7 Catamaran skimmer--Marco Class III. Courtesy Marco Corp., Seattle, WA.

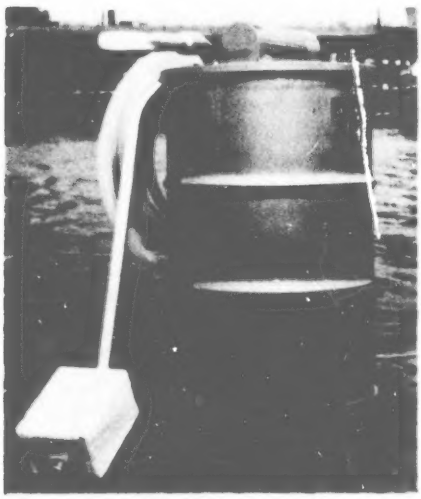


Fig. 3.8 Pneumatic vacuum system.

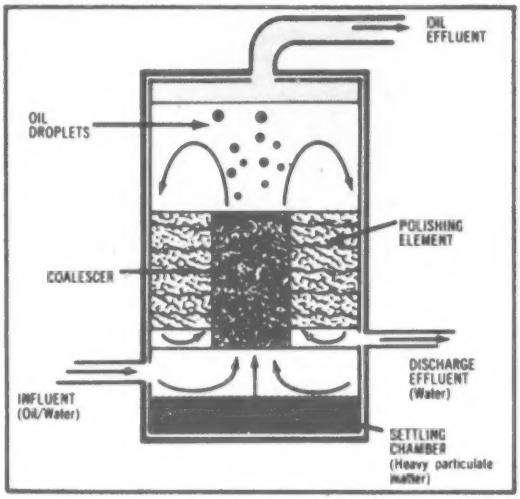


Fig. 3.9 Basic principle of the Rainbeaux oil/water separator.

4. ATTITUDE

A boat crew is a miniature society in itself. It has a hierarchy determined by job and seniority. Privileges are granted and enjoyed. Respect is earned through hard work and skill.

Harmony and order must be maintained and there are rules, both written and unwritten, which must be followed. It is the unwritten rules, learned only through hard work and experience, which can cause a new hand untold grief and give him memories of incidents he would just as soon forget.

Of all man's characteristics that contribute to his shipboard success or failure, the most important is attitude. This section will contain some pointers to get your career off to a good start.

4.1 Applying for a Job

Fig. 4.1 a,b

When you apply for a job, you should visit the company's personnel office, not just send an application to the company in the mail. The fact that you take enough interest to be interviewed personally may make you preferable to the company over someone the personnel manager has never met.

It is best, when filling out the application form, to be honest. Long-winded, untrue claims will be exposed as false sooner or later. And, in time, others will begin to question your word if you ever once falsify information.

On the application form, be sure to list all of your marine-related experience and credentials, such as tickets, licenses, endorsements, and education.

When visiting the company office, you should pay particular attention to your personal appearance. Do not wear dirty, torn, or wrinkled clothing. The job applicant should make sure that his shoes are shined and that he is neatly groomed. And, if you are a smoker, it is good manners to ask permission before you light up in a company office. Though common opinion is that seamen are grubs when they are ashore, that is not always so, and it is certainly not the correct way to get a good job.

If you are seeking to transfer from one company to another company, you should not belabor how unfairly you were treated, or how poorly another company was managed, or the like. No

matter how firmly you may be convinced of such facts, you will find that most company people know each other well, and they may even be good friends. Running down someone else, or another company, will reflect unfavorably upon you, the applicant. If you have gripes about a past employer, or if an incident occurred that reflects unfavorably upon you, wait until you are asked about it and then explain the circumstances fully and honestly. The high turnover rate of personnel in the marine industry may mean that the captain you are running down has previously worked long and well for the company to which you are applying.

You should always ask questions about wages, work schedules, travel arrangements, and insurance. The company interviewer will do his best to explain all the important factors of your employment with his company.

Most men are afraid to ask questions, however, the pertinent question is evidence of your sincere desire to work for the company. Such things as asking how many boats the company operates or commenting on the fact that you have seen one of the company's newer vessels will be looked upon as evidence of your interest. Personnel men have pride in their company, and it is rare that they can resist telling an applicant about the company's vessels and operations. Remember, many personnel men are former captains who would just as soon be behind the wheel of the boats.

Usually you will not be told immediately whether you have the job or not. Most personnel officers will take time to consider your application and to discuss your prospects with peers or immediate supervisors. Do not feel put out if you hear that old line: "We'll let you know if something comes up." You may have some competition for a particular opening, but other openings will occur and if you have made a favorable impression, you will be called.

In your initial job search you should apply at a number of companies. Do not just sit and wait to hear from one particular employer. The phone may not ring for a month, if ever. After making an application, if you really desire to work for one particular company, call and check on the prospects of employment from time to time. You should keep in touch, thus keeping in the personnel officer's memory.

4.2 Reporting to Work

Fig. 4.2

When you have been notified that you have been hired for a job you should do several things. First, you should find out when and where you are to report. Next, begin to prepare to go to work.

Preparations will soon become so routine that, as time goes on, they will become second nature. But it is good for the novice to keep some pointers in mind.

You should travel lightly, packing only those belongings that you are sure to need. Even by taking such precautions, it is still probable that you will pack about half as much the second time you go out. A good many vessels have washing machines and dryers, so all you really need is three or four changes of clothing. You should not forget such personal items as the toothbrush, razor and blades, comb, and other grooming items. After all, your face can get pretty itchy, your mouth can get stale, and your body odor might lose you a few friends. And, it is better not to fall into the habit of borrowing from others.

There are other things that you will probably need. One of them is a good pocket knife. And, in bad weather, though most companies provide slicker-suits and other foul-weather gear, it is probably best that you bring a lightweight jacket anyway. In colder months you should make sure to pack heavy clothing. Parkas, for example, are excellent for containing body heat and providing head coverage. A duffel bag is about the best container for the seaman's gear. However, if you can get by with one suitcase or a small athletic bag, these also serve well. Additionally, you may wish to mark all personal items with identifying tags.

Undoubtedly there will be lags aboard the vessel and some free time. Bring something to read, not only to improve the mind, but to help you keep your mind off friends and family ashore. Be careful of what you bring--some books and magazines may make you all the more eager to reach shore.

Before leaving for work be sure that everything ashore is shipshape and will run smoothly while you are away. If you live alone, you should see that all the doors are locked at your house or apartment, and that someone knows where you are going and when you will be back.

It is also important, if possible, to get a good night's sleep before going to work. Showing up for work disabled by a hangover will not be tolerated for long by your shipmates. Most men will find that the evening before leaving for a hitch is not a good time to visit friends or relatives--though, again, if you are single, it will be difficult not to see your girlfriend. Most men find themselves a little ill-at-ease and somewhat on edge as they realize that they will shortly be leaving, for a period of time, those things to which they have become accustomed ashore. Such uneasiness places a strain on the family as well as upon the seaman.

It is better to spend the evening at home, or if you are going out, to get in early. Get your packing done early in the day, if that is possible, to avoid the last minute rush. Fumbling around and looking for things at the last minute may mean that you will forget something important.

4.3 On Board

If you have not previously been introduced to the crew, the first thing you should do on boarding your new vessel is to introduce yourself to everyone.

Once you are aboard someone will tell you where to stow your gear. As soon as you get to your cabin, you should change into work clothes and report to the mate or the captain, one of whom will tell you what the routine is. If, by some chance, the mate or his captain is not around, then you should pitch in at whatever job the rest of the deck gang is doing.

Fig. 4.3

As soon as you get off watch you should unpack your gear and stow it. Be sure to put everything away so that it will not slide around the cabin. If you are sharing a cabin with a shipmate, don't spread your gear all over the room so that he does not have room for his gear. Eventually, your roommate will say something about your habits, and you will have created ill-will unnecessarily.

Also, if sharing a room, you should take the top bunk. Taking the top bunk is a courtesy that you owe to a senior man aboard. Though getting in and out the top bunk may present you with some inconvenience, remember that the rest of the crew has had its share of that kind of inconvenience also. Seniority will earn you such privileges as time passes.

Fig. 4.4

At mealtime you should not be the first to sit down. You should let one or two others be first. By taking your time in getting seated you avoid several things. For one, you do not get tagged with a reputation for being the first to get to the table. And, if other members of the crew have certain places at the table, where they are accustomed to sitting, you avoid a possible problem. The captain, for example, probably prefers a seat at the end of the table so that he can get up and get to the wheelhouse quickly in case of a problem.

You should not fill your plate to overflowing the first time around. When you see that everyone else has helped themselves, you can then go back for seconds when your first helping is gone. Remember, there may be one or two persons on watch who have yet to eat. Be certain to leave them something at chow-time.

At your earliest convenience you should check to make sure that you have a life-preserver in your quarters. Walk through

the boat noting fire-stations and life-saving equipment. It will not do for you, in case of emergency, to run around looking for a piece of emergency equipment.

Personal Cleanliness. It will be difficult to maintain yourself in a clean and presentable manner at all times While you are working this is not necessary, or expected, of course. But, when you knock off for the day, or prepare for bed or a meal, you should clean yourself up as well as circumstances permit.

No one enjoys sitting next to someone who smells like a garbage can. You should shower, as a minimum, once a day. And, you should shave daily. When you finish washing up, clean the sink. And don't leave all the dirt on the towel.

Work clothes deserve some attention also. Do not wear your jeans so long that when you take them off they can stand up in the corner by themselves.

Although cleaning tasks may be assigned on a different basis, it is the responsibility of those who occupy a room to keep it clean. If two men share a room, each should share a part of the burden of keeping it clean. Empty the wastebasket frequently and make up your bunk when you get out of it. If your cabin has an adjoining bathroom, it should be cleaned regularly.

Performance on the Job. Many of the men contemplating going to work in the marine industry wonder just what their job will entail. The answer is simple. A man does what he is told to do and as much more as he can accomplish.

In most instances you will simply be told to do something. The means by which you accomplish the job will, for the most part, be left up to you. This means that responsibility for determining the best way of going about the job rests with you. Do not waste the captain's time by asking where "this" or "that" is, or how you should go about doing a job. The captain probably does not know where "this" or "that" is any more than you do. Go look for it, or ask another member of the deck gang.

There will be some tasks with which you are totally unfamiliar. In such instances as these, it is up to the captain or the mate to get you started and to give you some pointers on how to accomplish the job. If they make no offer to assist or teach you, you should ask questions. You will find that older, more experienced men are generally eager to answer your questions about the best way to do something. They feel good that someone has taken the time to come to them for assistance. Your interest should not extend only to the job at hand, but to

other jobs which you see someone else doing, and which you can reasonably expect to be called upon to perform in the future.

Fig. 4.5

Doing Your Share. The minimum requirement for any work that a man undertakes is to do at least his share of the work. Do not let someone else carry your share of the load. It has been said that for the first few weeks of a man's employment aboard a vessel, he is a "passenger." In other words, he does not yet know the ropes, and of necessity others are carrying more than their usual burden while he is broken in.

It will be up to you to learn as fast as you can and to pitch in and help out wherever you can. You should never forget that while you are learning, one or two others, maybe even the entire crew, is being inconvenienced while they put forth their best effort to get you started. Do not feel guilty about this; someone did the same for all of the other crew members, and a man cannot start off being a top notch professional seaman in his first few days on the job. Just remember that you should work as hard as you can and show that you are trying.

Never worry about how much, or how little, the other man is doing. You should primarily concern yourself with you. You are being paid a wage to work. Concentrate on doing the job to which you are assigned, and remember to try to do your job thoroughly and with a minimum waste of time.

The captain and the mate will invariably know the men on the boat and they will see who is or who is not pulling his share of the load. Just because another man may not be working as hard as you does not grant you permission to automatically do as little as he is doing. The excuse, "but John Smith was not doing his work either," sounds very weak indeed when you are called on the carpet.

At times others may be assigned an easier job than you are assigned. You should not gripe to yourself about this. A job is a job. You have yours and they have theirs. No one is treating you unfairly by having you do the work for which you are being paid. Both the easy and difficult jobs must be done and you will undoubtedly have your share of the easy ones.

Always attempt to do more than you might consider your portion of the work. In making that extra effort you know that you are pulling your weight. And, by the way, the captain will quickly notice your effort too.

Be thorough with every task that you undertake. Never succumb to the temptation to do a hit and miss job. Sometimes it is very easy to take shortcuts and still end up with results that look as if you have done a thorough job. Do the job and

do it right. Remember, the boat is your home for the duration of the hitch and you owe it to yourself and to your shipmates to do your part in keeping the ship clean and sanitary.

You should never complain about the work that you are given. You are on trial in the eyes of the older hands, and you have to prove that you can stand up. At times you may be assigned some dirty and backbreaking work just to see how well you follow orders and what kind of worker you are. If you do the work and do not complain, you will more than likely find that things will ease up eventually.

The Company. There is a tendency among seamen to spend their coffee breaks or other free time commiserating with each other about the difficulties of their jobs. During such sessions, The Company invariably comes into the conversation.

The Company for which you work is never perfect and the office personnel are hindered by not being out on the boats and thus observing situations in which you are involved on a first-hand basis. Because of this you will find that you can, with some justification, find faults with some of The Company's policies and practices.

Although it is all right to discuss and identify these problems with your peers, you should not dwell unnecessarily upon such situations. It is the captain's job to make constructive suggestions to Company Management about some of the policies that need to be changed. You might be surprised to learn that The Company has no alternative but to follow certain policies if they wish to comply with regulations or to keep their boats employed.

The more the crew complains to each other about The Company, the more imagined injustices swell out of proportion. Pretty soon everyone is looking for an example of mistreatment so that they can join the conversation, and it is not long before everyone finds fault with The Company. You will be surprised at times how fast this poor attitude can permeate the atmosphere of a boat. Instead of doing a top notch job, the crew loses respect for The Company and the boat and dislike of The Management becomes the justification for doing a poor job.

You should always have pride in The Company for which you work. Similarly, you should have pride in the boat on which you are employed. If you have ideas for the improvement of certain rules and policies, you should make the suggestions openly to the captain and then to the office personnel. You will more than likely find that your Company is really not that much different from other companies. As a matter of fact, those who complain the loudest about The Company to the other crew members are usually the last to seek employment elsewhere. They simply enjoy complaining.

If you are really disgruntled about your treatment by the home office, the fairest thing for you to do is to seek employment with another company.

Fig. 4.6

In the Wheelhouse. You will find that part of your duties will entail work in the wheelhouse. Also, at night while you are on watch you may find yourself in the wheelhouse at the wheel or just helping keep lookout.

Keep out of the captain's chair! Some vessels have this chair specially placed and secured for the skipper's use. Don't make the captain ask you to get out of the chair so that he can use it. The skipper's judgment on the handling of the vessel is much more developed than yours. While you may be simply looking out through the window, he is constantly evaluating the situation. He needs access to the radar, radio, and a good clear range of vision. He bears the responsibility for the vessel and her crew. His desire for use of the chair doesn't center upon his wish to take a load off his feet. If you had his responsibilities you would be surprised at how uncomfortable that chair could become at times.

When they have company in the wheelhouse some skippers like to talk. On the other hand some discourage idle chatter in the wheelhouse. Beware of rambling on non-stop about your past loves and experiences. Such non-stop talking gets tiresome to the listener after awhile. Every boat has one man who is known as "old dysentery mouth," and people dread sharing a watch with him because he makes their ears sore. Talk may disrupt the skipper's concentration during touchy maneuvers.

In the wheelhouse don't sit or stand so that you block the only port looking in a certain direction. Be careful when smoking. A flaring match or lighter at night can destroy night vision for a number of minutes.

Don't camp in the wheelhouse whether it be during the day or at night. Your brilliant conversation doesn't absolve you from your duties elsewhere.

One of the oldest unwritten rules is that the deckhand on watch keeps the old man supplied with coffee during the watch. Don't forget this appreciated and important duty.

Fig. 4.7

Relations with the Rest of the Crew. While you are on the boat the situation is quite a bit different from being among a group of men ashore. Ashore, if you have a personality conflict with someone, you can avoid them. You don't have that choice aboard a boat. You are constantly thrust into the company of others, and constant cooperation is required to live and work in harmony.

Everyone's point of view is valuable. You can cling tenaciously to yours in any conversation, but some give and take is required. Don't be a know-it-all. Listen courteously to the other man when he is speaking. If you hear someone else getting carried away in his argument, his voice rising and his face flushing with the heat of the argument, get up and go outside for a walk on deck or read a book. Accept differences of opinion and don't get too involved arguing about politics or religion.

Avoid that deck of cards. Any number of decks have been thrown overboard by skippers who were tired of seeing the crew clustered around the table all the time to all hours of the day and night. If you do play cards, leave the money in your pocket. Gambling can swiftly destroy friendships and cause a lot of trouble.

Respect the next man's privacy. Never enter an occupied room without knocking. Always ask permission before entering someone else's room if they are not in the room. If something valuable is misplaced or stolen you will be suspect no matter how much the other person may tell you that you are not.

When other members of the crew are off watch and trying to sleep, don't make noise near their quarters. What seems to you to be a normal conversational voice may be unnecessarily loud.

You will find yourself imitating in voice, walk, and performance of duties the more colorful members of the crew. There is no harm in this if you pick a good example to follow. However, beware of imitating a goof-off who considers it clever to see how much work he can avoid. Merely being in this man's company can put you in a bad light.

Watch your language in company especially at the galley table. Foul language once acquired is hard to lose. While an occasional word finds its proper place in some situations, constant cursing and swearing are tiresome to hear. No one expects you to speak like a preacher, but beware of going overboard in the other direction. If you pick up this type of language, leave it on the boat when you get off.

Beware of offending the cook, especially by snide remarks at the table about his cooking. That meal took a lot of work to prepare even if you don't like the dishes being served. Clean up your dishes after you eat and also tidy up your place at the table. If you come in early for chow, pitch in putting the dishes and food on the table. Your courtesy will be appreciated, and an occasional compliment on the food won't hurt you either. Beware of complimenting a dish you really don't care for. You may find yourself being served that dish more often than you like in the future.

Letterwriting. When you have spent a couple of days away from home on your first trip you will be seized by an irresistible urge to write home. The contents of this letter are nearly the same no matter who writes it, and half of these letters are never put in the mail once they are written. You may write about how hard your job is, how much you miss your family or girlfriend, and how much you love them. Hold off on writing this letter for a couple of days until your objectivity returns. Inspired by homesickness, it will only distress your family and convince your girlfriend that you will marry her within the month. Imagine how uncomfortable you'll feel when you get off the boat and meet that girlfriend. From the contents of your last letter she is convinced that at any minute you're going to jump out in front of the nearest truck to prove your undying love for her. A certain amount of homesickness is natural but wait until it passes before you do anything you may later regret.

The Old Man. Boat captains come in a variety of shapes and temperaments. Their most common characteristic is the ability and confidence to make decisions and the willingness to accept the consequences of those decisions. Their skill and reputation are put on the line every day. The Old Man has climbed up the same ladder you are now climbing and it's nearly impossible to pull the wool over his eyes. At times it may seem to the novice that the skipper has a personal grudge against him, and it's true that some skippers can be quarrelsome and cantankerous. Chalk it up to the strain of the job. Learn as much as you can from him no matter what his disposition. Most captains are eager to share the knowledge that they have learned the hard way, and they take a personal interest in your progress. If the skipper has to tell you more than once to get something done, you should feel pretty embarrassed. One word from him should be sufficient. If you find the skipper on deck doing something that is your responsibility, he may be politely telling you to do a better job. Go out on deck and offer to take over and relieve him of the chore. Never knock off or relax while the old man is still working. Pitch in and give him a hand unless he declines your help.

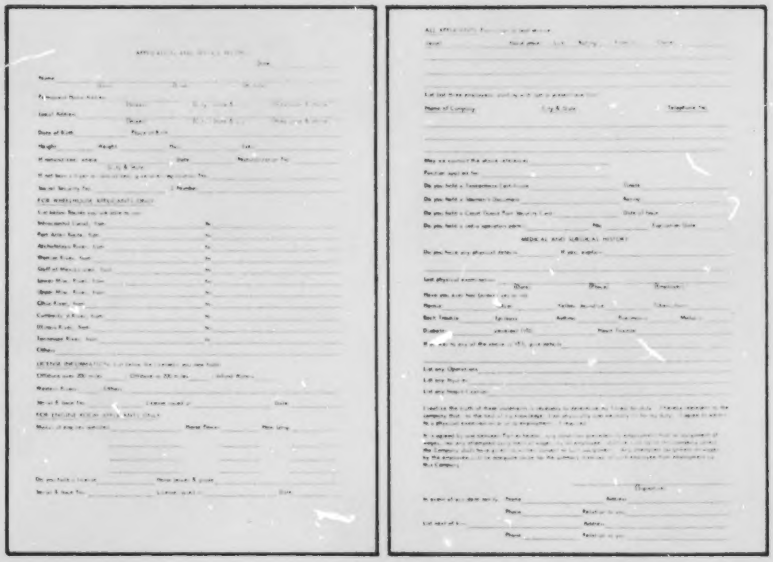


Fig. 4.1 Employment application. (a) Front; (b) back.

Fig. 4.2 Most companies furnish transportation to the vessel.

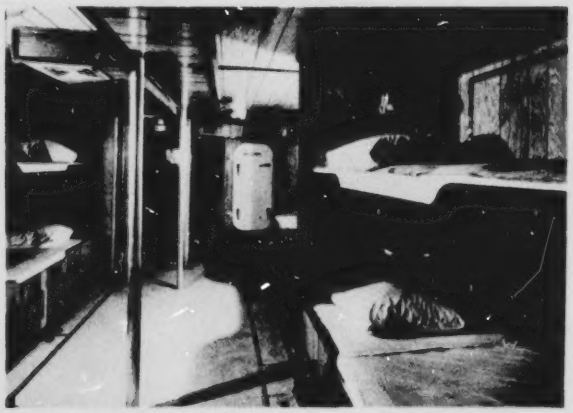


Fig. 4.3 The crew's quarters. Courtesy of The Photo Mart.

Fig. 4.4 Etiquette is important at the galley table.

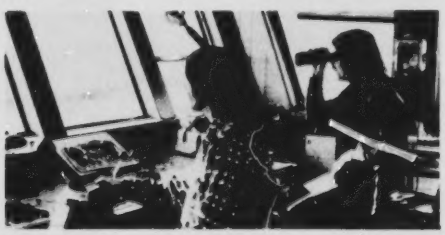


Fig. 4.6 On watch in the wheelhouse.

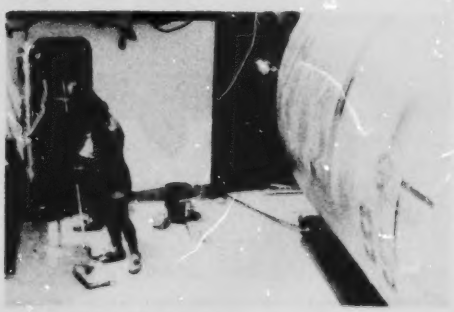


Fig. 4.5 Regardless of the job, always do more than your "share."

Fig. 4.7 Coffee time.

5. SEAMANSHIP

Seamanship is an art that a sailor, deckhand, or any seafaring individual must master to perform tasks on vessels in keeping with the highest traditions of mariners.

Generally, seamanship can be divided into three categories: (1) marlinspike seamanship, (2) deck seamanship, and (3) boat seamanship. In this section, the basics in each of the three categories will be explained.

5.1 Marlinspike Seamanship

The nautical term that is given to the art of handling and working with all kinds of fiber and wire rope is marlinspike seamanship. This art includes knotting, splicing, worming, parceling, serving, and fancywork.

Line Construction. A seaman refers to fiber rope as "line." Line is constructed in the manner illustrated in Figure 5.1. First, the fibers from various plants, depending upon the type of line, are twisted clockwise to form yarns. The yarns are then twisted counterclockwise to make strands. Strands are then twisted clockwise again to form line. Line that is twisted together is referred to as cable-laid line. One can readily see that cable-laid line would increase the strength of the line, and at the same time, give it more elasticity (stretching-power).

Fig. 5.1

Line is measured in circumference and designated by different names according to the size of the circumference. Table 5.1 illustrates the designation of line.

Practically all line is right-hand laid, which means that when one looks down the line, it spirals in a right-hand (clockwise) direction. Cable-laid line spirals in the opposite direction (counterclockwise).

Types of Line. Fiber line is manufactured from natural and artificial fibers. Under the natural fibers one finds manila, which is strongest of the natural fibers and therefore the most expensive. Manila line is made from the abaca or wild banana plant, which is raised primarily in the Philippine Islands. Hemp is another fiber that is used to construct line. It is obtained from the hemp plant and as a rule is usually mixed with other fibers such as sisal or manila, to form mixed or composite lines. Sisal, which is acquired from the sisal plants that are raised in Java, East Africa, the Bahamas, and also Mexico, is the easiest fiber to identify. It is extremely

Table 5.1 Designation of Line.

Circumference	Designation
smaller	
3/4"	6 thread
1"	9 thread
1 1/8"	12 thread
1 1/4"	15 thread
1 1/2"	21 thread
2"	line
3"	line
4"	line
5"	Hawser
6"	Hawser
larger	Hawser

light colored, almost white. The most commonly used of all the fiber lines is the small white line that is made from the cotton or flax plant. One would use the cotton lines aboard ship for lead lines, signal halyards, heaving lines, clothes lines, etc.

Nylon is the most frequently used line in the mineral and oil industry, despite the fact that nylon is an artificial fiber. Nylon offers several advantages. First, it has strength that is approximately twice that of manila line of the same size. Nylon is much lighter and more flexible, making it less bulky at the same time. The nylon line is easier to handle and stow, it resists rot, decay, and marine-fungus growth. The most important and main quality of nylon is its ability to stretch, absorb shocks, and then to resume its normal length when the strain is removed. But the unique physical properties of nylon can be hazardous. For instance, when nylon is stretched 40 percent, it is apt to part (break). Upon its parting, the stretch incurred by the nylon under strain is recovered immediately, and the snapback could be fatal to any man standing in the direct line of pull.

Polyethylene is another artificial fiber line that is widely used in the mineral and oil industry. It has the ability to resist moisture and chemicals, which is the primary cause for most deterioration of various type lines. The main disadvantage of it is that when strain is placed on it, there is no noticeable stretch and therefore no fair warning to the seaman before polyethylene parts.

Making Up Line. To coil a line, circles of line are placed one on top of the other, in a predetermined desired circumference. Coiling is done in the same direction toward which the line is laid. In other words, right-hand laid line should be coiled in a clockwise direction, left-hand laid line should be coiled in a counterclockwise direction.

Fig. 5.2

In flemishing a line the coils are formed alongside each other, with the end of the line in the middle. Then after all the line has been used, the bitter end in the middle is rotated in the direction that it was coiled in order to tighten the entire amount of line, making it flat and uniform in appearance.

Fig. 5.3

Another kind of line make-up is known as faking. Faking is done by starting with the bitter end and placing the line side by side in long extended bights. The length is determined by the space available for faking, or to the necessary required length toward which you are working. The method of faking in making up a line is used when the line has to run free, i.e., "a messenger."

Caring for Line. If proper care of line is taken, it will deteriorate only from old age and not moisture and chemicals,

which will cut down on cost and could possibly save lives. The first item in caring for line is to open a new coil of line properly. Upon being assigned to open a new coil of line, you should inspect the coil and try to locate a tag that is attached to one end of the coil. Read and follow the directions on the tag. The card might say, for example, "this end up." Put that end up, and then cut all lines that hold the burlap around the coil, reach into the center, and pull the end. After you have pulled out a few feet of the line, and for some reason you notice that kinks are appearing, stop! Replace what line you have already pulled out and simply end-for-end your coil. Turn the coil so that the other side is up. Then reach into the center of the coil again and pull the bitter end, and you should have no more problems.

Fig. 5.4

All line should be stowed in a dry place. Coils of line should always be stowed uncovered on shelves or platforms, clear of the deck. Never allow gear to accumulate on coils; besides being a poor practice, it will prevent evaporation of moisture from the coils.

Any running rigging with fiber rope, or any secured lines, i.e., mooring lines or boatfalls, must be watched and slackened in wet weather. Remember, all line will shrink when damp and stretch when dry. All line should be checked periodically for deterioration: untwist the line and look inside. If the inner parts of the strands look dull and gray instead of yellow-white, the line should be surveyed (discarded). The inner parts of the strands should have a clean yellowish-white look. Line that has been overworked or overstrained will develop bristles on its surface. These bristles appear because many of the fibers have been worn, broken, or displaced. Any line that is used for handling cargo or personnel should be checked periodically, and if signs of deterioration are noted, immediate replacement should be made.

Nylon line, being made from artificial fibers, has to be cared for in a different way. Nylon line, to start with, does not come in coils as do other types of line. It is obtained from the manufacturer on reels. To remove it from the reel, you should choose one of the following two ways: (1) Place the reel in a position to roll as a wheel. You would then insert a piece of pipe or pry bar through the very middle of the reel so that you have at least one foot of axle protruding on each side of the reel. Then secure a line of sufficient size on each end of the axle and, raising one end of the reel at a time, secure the opposite end of each line to an overhead or strongback, just to make sure that the reel of nylon will rotate clear of the deck. After this procedure is followed, you may grab the bitter end of nylon from the reel and pull steadily. Do not try to go too fast because you will end up with what is called in fishing, a back lash. (2) The preceding method of slinging

the reel up is by far the best way. But you may find yourself in a situation where you do not have an overhead or strongback. Do not panic. Just lay the reel down as you did in the previous method. Instead of raising the reel up, just roll the reel down the deck. This way will take longer but it will enable you to get the nylon from the reel without kinks. Kinks in the line have a tendency to cause the line to unlay and especially weaken the line in the area where the kink is.

Breaking Strength of Line. A seaman depends upon certain well-established formulas to tell him what size line is required in each situation.

The breaking strength of a line indicates at what stress (or weight) the line will part. Often this information is supplied by the manufacturer. In the absence of this information, the mariner can use the formula for manila line:

$$BS = 900\ C^2$$

where

BS = the breaking strength of the line in pounds
C = the circumference of the line

Nylon line is approximately three times as strong as manila line so multiply the end product by three to find breaking strength for nylon line of the same circumference.

For instance, the breaking strength for a 1" circumference line is 900 pounds. The breaking strength of a 1" circumference nylon line is approximately 2700 pounds (3 x 900).

At times a line is called upon to carry a far greater load than was originally planned. Also, line deteriorates through normal wear and tear and exposure to the elements. For these reasons, a prudent seaman never uses a line that just meets the demands he will make upon it. Line is selected in accordance with a safety factor. For instance, all line used with lifesaving gear carries a minimum safety factor of six. This means that should the line ordinarily be expected to carry a load of 100 pounds, a line with a breaking strength of 6 x 100 pounds would be used.

The relationship between breaking strength and safety factor is expressed by the formula:

$$BS = SF \times SWL$$

where

BS = breaking strength
SF = safety factor
SWL = safe working load

The safe working load represents the load that will normally be placed on the line.

Example: A seaman wishes to use a line to lift a load of 200 pounds. He wishes to use a safety factor of three. What breaking strength should the line have?

Answer: (a) BS = SF x SWL (b) BS = 3 x 200 (c) BS = 600

Knots, Bends, and Hitches in Line. You should now be ready to put all that you have learned into action by actually using line to tie knots, bends, and hitches. Knowing how to tie knots is not the sole answer to the art of knotting. Each knot has a special characteristic that makes it especially applicable to certain tasks. For example, to bend two lines of equal size together, what knot would you use? If you did not pick the squareknot, you are in error.

Fig. 5.5 a,b

Knots are used to form eyes or to secure a line around an object such as a package. So in reality, the line is bent to itself. Bends are used to secure lines together. Hitches are used to bend a line to, or around, an object such as a ring, spar, stanchion, etc. You, the seaman, will now be given the name of the most commonly used knots and when they are functional.

The bowline, with its variations, is one of the most useful of knots. Its chief use is to form an eye in the bitter end of a line. It is also useful to secure a line in a padeye or other ring or around a stanchion or other object. In addition, the bowline can be used to bend two lines together by tying an eye within an eye. Spanish bowline is a variation of the bowline. The Spanish bowline can be used if you need two eyes in a single line. Primarily it is used as a substitute for the boatswain's chair. As you have two eyes, a seaman may place a leg in each eye and then be lowered over the side of a vessel or lifted aloft to perform various jobs in a sitting position. Another knot derived from the bowline is the French bowline, and it can be used for lowering personnel or lifting personnel aloft as the Spanish bowline can. The difference in the two is that you can render one of the eyes around in the French bowline and the other automatically becomes smaller, whereas the eyes in the Spanish bowline are permanent and cannot be rendered around to reduce the size of either. A "bowline on a bight" is used in a length of line when a single eye is needed in the standing part of the line. This knot is especially handy when you are securing for sea, because a line that is run around an object can have a bowline on a bight placed in it to receive a turnbuckle to make your lashing taut.

To be initiated into the seafarer's fraternity you need to know the dragging bowline, or else be dubbed a "worm." When asked to tie the dragging bowline, simply look serious and

nonchalantly tie a plain bowline, then place it on the deck and proceed to walk, still holding onto the bitter end of the line, dragging the bowline.

The square knot or reef knot is used to bend two lines of equal size together. As there is a knot used strictly for bending two lines together, the question arises, what knot is used to secure two lines together of unequal size? You would use a single or double becket bend. The stopper hitch, sometimes called the rolling hitch, is a handy knot when you are engaged in salvage work, or anytime you are using lines under strain in conjunction with fairleads that have to be removed to secure the lines to bitts or cleats. Let us assume that you are mooring a vessel alongside a pier and the current is running in the opposite direction to which you are mooring. In this situation, you would undoubtedly run out a line to the pier as soon as you could. Then, having the bitter end secured to the pier, you would fairlead the standing part to a source of power in order to facilitate taking a strain. After you have acquired your desired position, you then would want to slack your line, remove it from your source of power, and make it fast to a cleat or bitts. Tying a stopper hitch on the line with the strain, you can do all this without losing your position.

Roustabouts off-loading supply boats can make use of the timber hitch knot. It can be used to lift logs, spars, planks, or comparatively rough-surfaced material. Do not attempt to use the timber hitch to lift pipe or you will be acquainted with a too frequently used term in the Gulf: "Pack your bag and go to the house." You have been run off because you have just lost a load of pipe; pipe, being smooth surfaced, slipped and fell from the timber hitch.

Sometimes you may run into a situation where you have a piece of line to use, but the piece you have in your possession is entirely too long. Do not fret--use the sheepshank and your problem is solved.

Splicing. Also important in learning marlinspike seamanship is to learn the art of splicing. To loop any line permanently to form an eye in the bitter end, you will have to eye-splice.

Fig. 5.6

The eye-splice is done after you have estimated the length of the line you will need to unlay for your complete splice. This precautionary estimation will keep the seaman from finishing short, or having to waste a lot of line by cutting it off. After unlaying the line as necessary, you splice them into the standing part of the line. This is done by tucking the unlaid strands from the end into the standing part. An ordinary eye-splice should have three tucks. Start by entering the unlaid

ends into the standing part, then make two more complete rounds. With large lines you must whip the ends of the strands before you start, otherwise the strands will frazzle out and become troublesome (Fig. 5.6).

With any line up to two inches, as a rule, you can open the strands in the standing part with your fingers. But for larger lines, the fid must be used as the tool to allow you to place the bitter end into the standing part without any trouble.

Short splice lines are those spliced together when a slight enlargement of the original diameter of line is unimportant. To short splice, seize the ends together so that each strand is one bitter end and will lie along a corresponding strand in the other.

Fig. 5.7

With large lines you will have to put on a temporary seizing where they join. The seizing keeps them from suddenly coming apart. You may do that with small lines also until you get the knack of holding them together while you tuck. Once you have seizing on, you simply tuck over and under as you ended your eye-splice, with three tucks on either side of the seizing (Fig. 5.7).

A seaman uses the long splice when he needs to splice two lines together and still retain the line in its original size. You might have to render the line through a block and if the line is increased in size, it would not pass through the swallow. To make this splice, unlay the line about fifteen turns. Seize the strands together, the same as in the short splice, leaving one strand out of the seizing. Then, unlay that strand and replace it with the opposite strand. While you lay in this strand, give it a sort of backward twist and it will lay in place better. When you reach the end of the strand, take both strands and simply tie an overhand knot in it, making sure that your overhand knot goes in the same direction as the lay of your line. You may now select another pair of strands and repeat your previous action. When you have tied your overhand knot in this manner, you go to your last pair of ends, near your seizing, and just move it one inch or so in either direction and tie your third overhand knot. Now that you have three overhand knots and two bitter ends at each, take one bitter end at the time and go over and under, tucking each strand. You then cut the excess line away and place a temporary whipping around each to prevent them from pulling out.

Fig. 5.8

Fig. 5.9

Using the Line to Secure. You are required to learn these knots, bends, and hitches to use them when necessary. You may rest assured that a man who goes to sea will find frequent use for these knots, bends, and hitches, in securing his gear for sea. Exactly how your gear may be secured depends on the gear and the places of stowage, but by observing the following tips

(Table 5.2), and by using a little common sense, you should be able to do a fair job of securing gear for sea.

Table 5.2. Rules of thumb for securing gear.

1. Use good line strong enough to hold the gear. Make certain the line is in good condition.
2. Belay objects from at least two points, which, preferably, are near to the object.
3. All objects must be lashed tight against something solid, such as a bulkhead.
4. Make the lashings taut so that the object will not "work" with the pitch and roll of the ship. Frequently check all lashings and re-tighten as necessary.
5. Use chafing gear on sharp corners and rough surfaces.
6. Never make fast your lashings to electric cables or small, lightly secured pipes, lagged pipes, door and hatch dogs or hinges, electric motors, lifeline stanchions, or anything not solidly secured.
7. Never block access to vents, fire plugs, switches, valves, or doors and hatches.
8. NEVER UNDERESTIMATE THE FORCE OF THE SEA. Secure everything properly the first time and be safe!

Fig. 5.10

Wire Rope Construction. Part of marlinspike seamanship is to understand wire rope construction and usage. The basic unit of wire rope construction is the individual wire. It is constructed of steel, bronze, plow steel, or other metal in various sizes. Individual wires are laid together to form strands. The strands are then laid up around a central core, which may be only a single wire, a single strand of wire, or hem line, to form the wire rope. The core has three purposes: (1) It gives the wire more flexibility, (2) it cushions the strands when the wire is under strain, and (3) it holds part of a lubricant for continuing lubrication. Wire rope is either preformed or non-preformed. Preformed means that before they are layed up each strand is shaped to conform to the curvature of the finished wire rope. The main advantage of the preformed method of fabricating wire is that in this method, if parted for some unforseen reason, the wire rope will not unlay to any great extent. The non-preformed wire rope is layed on the outside of a core and is twisted to its desired curvature in one step, and this type of wire, if cut or parted, will unlay with force.

Fig. 5.11

All wire rope is measured by its diameter and is designated by the number of strands per rope and the number of wires per strand. For example, 6 x 37 means six strands are used to make up the wire rope, with thirty-seven individual wires per strand.

Types. Wire rope is fabricated in several grades of steel, for example, improved plow steel, plow steel, mild plow steel, and cast steel. Other grades of metal for special purpose wire rope include iron, bronze, and even stainless steel. These metals, being the basic metals of wire rope construction, may be plain or galvanized, but galvanizing makes the wire rope stiffer and reduces the strength by as much as 10 percent. Make sure you consider this when selecting wire to lift a load of great weight (see Table 5.3).

Table 5.3. The uses of wire rope.

Size	Job Performance	
6 x 7	Used for permanent rigging such as shrouds and stays	
6 x 19	Used mostly on derricks and dredges for extreme heavy hoisting, for the topping lifts of booms, standing rigging, guys, and boat slings	Strongest of all wire ropes
6 x 19 (bronze)	For lifelines, wheel ropes, radio antennas, and antenna downleads	Where either noncorrosive or nonmagnetic properties are desirable
6 x 37	Used for cranes and similar machinery, steering gears, boat falls, towing hawsers, bridles, and various running-rigging	Flexible and suitable in more cases than any other designated sizes

Flexible wire rope, called springlay, is often used for wires that require a good deal of handling, such as mooring lines. Flexible wire rope is composed partly of wire and partly of fiber line. Therefore, it has substantially less strength than all steel wire of corresponding size. Springlay, incidentally, is always galvanized.

Care of Wire Rope. The care of wire rope is important. All exposed wire, whether galvanized or not, must be slushed (covered with some surface coating) for protection against the elements. For standing rigging (wire rope not subject to wear), weather protection is the main concern. Linseed oil, white lead, and tallow are the preservatives you should use. Wire rope for running-rigging, various winches, boatfalls, etc., must be slushed with a mixture of graphite and grease. This mixture will provide the wire with lubrication as well as protection from the weather. Right-laid wire rope, like right-laid line, should be taken clockwise around catheads or capstans to avoid kinking. You should always avoid kinks in any make up of your wire rope. A heavy strain on a wire with a kink would be disastrous. It would part and you would lose your load. Wire that has had a long usage will wear; the outer parts of the strands will begin to flatten out, and you will find a decrease in the original diameter. The wire will develop a large amount of fishhooks also.

Handling Wire Rope. When handling wire rope the seaman should always wear gloves. Make sure that the gloves fit because occasionally you will incur a fishhook that will inflict a painful hand injury if the wire rope slides through your unprotected hand. Wire direct from the manufacturer, whether on a reel or a coil, must be unwound--never picked up in bights. If you picked up the wire in bights, you would end up with something resembling a bed spring. The outside end always is run out first. If your wire is on reels you can and should do the same things you do with nylon to get it off the reel.

Fig. 5.12

Fig. 5.13

Breaking Strength of Wire Rope. The relationship between breaking strength, safety factor, and safe working load holds true for wire also and is expressed by the formula:

$$BS = SF \times SWL$$

However, the breaking strength of wire rope is computed by means of the formula, $BS = 25d^2$. The breaking strength of wire rope in tons is equal to twenty-five times the diameter of the rope squared. As an example, a one-inch diameter wire rope would have a breaking strength of twenty-five tons.

5.2 Deck Seamanship

Deck seamanship is the rigging, operation, and maintenance of the ship's equipment located either on the deck or aloft. A person versed in deck seamanship must know the purpose of everything topside, how it is rigged out for operations, how it is operated properly and safely, how it is rigged in and secured for sea, and how it is kept in proper working order.

Rigging. Every outside area of a vessel, from jackstaff to flagstaff, and from truck to waterline, must be easily accessible to a deck seaman. Rigging in general is a large phase of deck seamanship.

The vessel's rigging proper consists of the lines or wires that support the masts, stacks, yards, etc. All of these are standing rigging. Next are those that are used in hoisting and lowering weights or in positioning and operating the vessel's movable deck gear, which is called running rigging. The process of setting up an apparatus containing rigging is called "rigging." In other words, rigging cargo gear, rigging stages, etc.

Blocks and Tackles. Blocks and tackles, or just tackle, is and important element in almost any type of running-rigging.

A block is defined as an encased roller revolving on a pin. The parts of a single sheave wood shell block are shown in Figure 5.14. By an "encased" roller is meant the sheave. The sheave is encased in the shell of the block. A pin passes through the sheave and holds it inside the block. Many different types of bearings may be used to make the sheave revolve smoothly on the pin. Bearings, or bushings, may be plain or iron bushings, bronzed bushings, roller bushings, self-lubricating iron or bronze bushings, and sealed roller or ball bearings. Blocks may be fitted on the pin, or it may be necessary to remove the pins for periodic lubrication. Sheaves also may be found with fittings on the sheave hubs where these are accessible for lubrication. Blocks may be metal or wood shelled. Snatch blocks are blocks on which one of the cheeks of the block may be opened to allow placing a line or cable on the sheave without reeving the bitter end through the block. Whenever a snatch block is in use on deck, people should keep clear of the work going on. The seaman should make sure that the wire has a good fairlead through the block and that as the strain is placed on the wire, the snatch block leads clear.

Fig. 5.14

Threading a line through a block is known as reeving the line through the block. The seaman must exercise caution to select the proper size block for use with the line he intends to reeve through it. With natural fiber line such as manila, the length of the shell of the block should be three times the circumference of the line. The minimum diameter of the sheave should be twice the circumference of the line in inches. When wire rope is being reeved through the block, the diameter of the sheave should be not less than 20 times the diameter of the wire.

When blocks are being used as a fairlead to a drum or gypsyhead, they should be placed in such a position that the fall or hawser leads at right angles to the axis of the drum and at mid-length of the drum. The block should be placed at

such a distance from the winch that the rope will not ride over an adjacent turn at any time, upon being wound in during hoisting or heaving. Also, it should be placed so that the wire will not rub on the cheek of the block.

A tackle is a system of ropes and blocks used to multiply power or to change the direction of pull on a weight. The ropes used in a tackle are called falls. The end of the fall connected to one of the blocks is called the standing part, and the other end of the fall is called the hauling part.

Fig. 5.15

Figure 5.15 shows several different tackles. Through the years each has developed its own specific name according to how many blocks are used or according to how many sheaves are in each block. Each tackle has a mechanical advantage except the single whip. The single whip offers no mechanical advantage, but it serves to change the direction of hauling. Mechanical advantage means how much stronger the tackle makes the man or winch pulling on the hauling part. The mechanical advantage of a tackle can be determined as the number of parts of line at the moving block. For example, if a man were using a gun tackle to lift a 200-pound weight, his pull would be increased by two times. To find out how much force the man would have to exert to lift the weight, we simply divide the weight, 200 pounds, by 2. This equals 100 pounds. The man would have to exert 100 pounds of force to lift the weight. In solving the problem above we purposely did not discuss friction. Although every attempt is made to reduce the friction of the sheaves in the blocks on their pins, friction is present and adds to the amount of force that the man must exert to lift the weight. A formula has been developed to take friction into account when determining the amount of force required to lift a weight with a given tackle. This formula is:

$$F = \frac{W + (W \times .1 \times \text{number of sheaves})}{MA}$$

F = force
W = weight
Number of sheaves = total number of sheaves in the tackle
MA = mechanical advantage

Previously, we calculated that a man would have to exert a pull or force of 100 pounds to lift a 200 pound weight without friction. Let us rework the problem using the correct formula and take friction into account.

$$F = \frac{200 + (200 \times .1 \times 2)}{2}$$

$$F = \frac{200 + 40}{2} = \frac{240}{2} = 120 \text{ pounds}$$

Work the example problems below:

1. A winch will be used to lift a 400 pound weight with a luff. How much pull or force must the winch be capable of providing?

2. A double luff tackle will be used to lift a 400 pound weight. How much force must be exerted on the hauling part of the line to lift the weight?

3. A man is using a three fold purchase to lift a 644 pound weight. How much force must the man exert?

4. A gun tackle is being used to lift a 122 pound weight. How much force must be exerted to lift the weight?

Answers: (1) 173.3 pounds (2) 120 pounds (3) 171.7 pounds (4) 73.2 pounds

If tackles with an even number of sheaves are set up so that the hauling part of the falls leads from the moving block, the mechanical advantage of the tackle is increased by one. Shown in Figure 5.16 is a gun tackle that has been rove to maximum advantage. You will remember that the regular mechanical advantage of a gun tackle is two. However, by counting the number of parts of line at the moving block in Figure 5.15, you can see that the mechanical advantage is now three.

Fig. 5.16

An example of how to calculate force when using a tackle rove to maximum advantage is as follows.

A man wishes to lift a 725 pound weight using a two-fold purchase rove to maximum advantage. How much force must he apply to lift the weight?

$$F = \frac{W + (W \times .1 \times \text{no. of sheaves})}{MA}$$

$$F = \frac{725 + (725 \times .4)}{5}$$

$$F = 203 \text{ pounds}$$

Work the following problems on tackles rove to maximum advantage.

1. Two men wish to use a gun tackle rove to maximum advantage to a 266 pound weight. How much will each have to pull?

2. A winch with a pull of 100 pounds is going to be used to lift a 400 pound weight by means of a two-fold purchase rove to maximum advantage. Can the winch lift the weight?

Answers: (1) 53.2 pounds of force (2) 112 pounds of force, therefore, no.

Fig. 5.17

Anchors. A vessel's anchors are used not only to hold her in position when the propulsion engines are shut down, but also to aid in maneuvering the vessel.

Anchors are usually made of cast steel. The fittings and the shanks of housing anchors are made of forged steel. They vary in weight from 30 to 30,000 pounds and their weight, serial number, and the date of manufacture are stamped into the crown or shank. Edges of the anchors are smoothed to prevent damage to the vessel's hull when hoisting.

A vessel may carry various types of anchors. Their names are derived from the position or use of the anchor, regardless of the type (see Table 5.4).

Table 5.4. Anchor types and definitions.

Bower Anchor	The anchor carried on the bow and used for all anchoring.
Stream Anchor	A medium weight anchor for miscellaneous use. Named stream anchor because it is carried at the stern of some vessels and is frequently required to anchor in rivers and other confined waters.
Stern Anchor	An anchor carried on the stern regardless of weight or purpose.
Kedges or Warping Anchors	Anchors not usually over one ton in weight. These are used to move a ship ahead a small distance at a time by taking one of the anchors out in a small boat, letting it go, and then heaving the ship up to it. When this is done to change the heading of the ship, it is called warping.

Fig. 5.18

An anchor windlass is the engine used to hoist a bower anchor in on the vessel. There are two types of windlasses, the vertical shaft type, which is used on most combat ships, and the horizontal shaft type, which is used on most merchant vessels and vessels used in the mineral and oil industry.

On the vertical shaft windlass, the brake handwheel, engine control, capstan head, and wildcat are the only parts

above the deck. All the remaining machinery is located below decks, in the anchor windlass room. The capstan head, a part of the shaft, is used with the wildcat, disengaged, for heaving in on lines. The wildcat, just below the capstan head, contains teeth that engage the links of the anchor chain. The wildcat may be engaged to or disengaged from the shaft by turning the locking handwheel in the windlass room. There is a friction brake that may be set up by the brake handwheel to prevent the wildcat from rotating when it is disengaged.

The horizontal shaft windlass has all machinery above the deck. There are two wildcats on the shaft. One is on each end to facilitate the use of both the starboard and port anchor. Each wildcat may be locked to the shaft or unlocked so as to rotate independently of the shaft. The locking head on the windlass is engaged or disengaged by means of a thrust cam. The thrust cam is shifted by a quarter turn with an iron bar, which fits into a slot on the cam.

Letting go the anchor on a supply boat is accomplished by the following step-by-step procedure:

1) Determine the depth of the water.

2) Obtain power on the anchor windlass.

3) Release the hand brake.

4) Engage the wildcat; heave around on the chain until all strain is off the stoppers.

5) Release all stoppers. Avast heaving on the chain and tighten the hand brake.

6) At this point, depending upon the depth of the water, the anchor may either be walked out or dropped when a signal is received from the wheelhouse.

7) If the anchor is to be walked out, the brake is released and the chain paid out by using the wildcat engaged to the windlass motor.

8) If the anchor is to be dropped, the wildcat is disengaged so that it will free-wheel when the hand brake is released. At the words "let go," the hand brake is released and the anchor let go. The chain will go rattling out with a roar, until the instant of slackening speed indicates that the anchor has hit the bottom. At this instant the man at the hand brake should start braking to keep from piling chain upon the anchor.

Keep the wheelhouse informed once the anchor is down. It is important that the bridge know at all times how much chain

is out and which way it is tending. As each mark passes the windlass, the word is passed "15 fathoms on deck, 30 fathoms on deck, etc." Once the chain has stopped running out, word is passed from the forecastle deck that "so and so fathoms are at the water edge." Word is passed repeatedly as to which way the chain tends, as, tending forward (aft); and the amount of tension on it, as, no strain, slight strain, moderate strain, etc. Word must be given instantly if the chain gets across the stem. A strain on it then must be particularly avoided, otherwise bending damage to the chain and especially to the detachable links may result.

Once the desired scope is out, vessels generally set up one or more chain stoppers and ride to them, with brake set and the wildcat disengaged.

Line Handing Gear. Line handling gear on modern vessels is used in mooring the vessel and in towing other vessels. Such gear has eliminated a lot of sweat and backbreaking toil from the seaman's daily routine.

The capstan is a special type of deck machinery used primarily as an aid in handling mooring lines or wires. The large mooring lines are heavy, and, when working with them, most of the lines are over the side, adding to the difficulty. The essential feature of the capstan is the vertical spool-shaped drum fitted with pawls. Whelps or ridges on the drum are provided to keep the lines from slipping, especially when wet. Capstans are powered by electricity. Capstans may be located any place on the deck of a ship, depending upon its type and size. As stated in the section on the anchor windlass, a capstan head may be attached to a vertical shaft anchor windlass. This dual purpose machine is found quite frequently aboard ships and is always located on the forecastle. Not to be confused with this, however, is the separate piece of deck machinery described above.

Winches consist of a rugged bedplate and side frames upon which are mounted a horizontal drum shaft, drums, and/or gypsy heads, reduction gearing, and the motor or engine that drives the winch. The operating controls may or may not be mounted upon the same base, but ordinarily they would be situated where the operator also could operate the brake lever.

Fig. 5.19

The various types of winches include the drum winch. Drum winches are those with drums on which rope is wound for raising, lowering, or pulling loads. Depending upon their purpose, the drum winches may have from one to four drums.

Another kind of winch is the gypsy winch. These gypsy winches are also called warping or snaking winches. They have

one or two horizontally mounted gypsyheads around which several turns of rope can be taken in order to pull or hoist a load. Some gypsies are provided with raised portions called whelps, which reduce the rope's tendency to slip.

A third kind of winch is the combination winch. These are simply drum winches with shafts extended far enough to take gypsy drum winch heads on either side or both sides.

Drum winches may be powered by any number of means. Electric drives consist of a motor, either alternating or direct current, which actuates a drive shaft through reduction gearing. The AC drives normally have one speed, but for special applications, a second speed may be added. The DC drives can be built with an infinite number of speeds, but normally only three to five in each direction are provided. When a winch with wide speed gage, fine control, and smooth acceleration is required for installation in an AC powered ship, an electric-hydraulic winch is sometimes used. Drive equipment comprises a constant speed electric motor that drives a variable displacement pump and a hydraulic motor, that, through reduction gears, drives the shaft of the winch. A manual control regulates the stroke of the pump and its output and thereby determines the speed of the motor. Steam winches provide smooth acceleration and a wide range of speed. They are normally powered by double-cylinder steam engines, the pistons of which drive crankshafts and, through gearing, the drum and drive shaft. Speed and direction are controlled by means of a lever operating a reverse valve. In some winches compound gearing allows for two different loads with the same amount of power. Air winches, like steam winches, provide smooth acceleration and a wide range of speed. The drive consists of an air motor that actuates the drive shaft through reduction gearing. In gasoline and diesel engine powered winches the prime mover is the engine. The engine actuates the shaft through a torque converter and reduction gearing. The torque converter provides for an infinite number of speeds. Speed also can be controlled by increasing or decreasing the revolutions of the engine. Usually these winches are designed as a unit with the engine and winch mounted on the same bedplate. Frequently they are portable. Hand winches ordinarily consist of a single drum mounted horizontally on a shaft, a hand brake, reduction gearing, pawl and ratchet, and a handwheel or handcrank. They may be single or two speed units.

General operating instructions for winches are given in Table 5.5.

Mooring the Vessel. A vessel is moored when she is made fast to a mooring buoy, when she is swinging on a bight of chain between two anchors, or when she is secured alongside a pier or another ship by lines.

Table 5.5. General operating instructions for winches.

1. Inspect the area around the winch making sure that there is a safe place for the winchman to stand. If the deck is slippery, lay down some dunnage on which the winchman can stand.
2. Inspect all rigging, making certain that the rigging is not fouled or loose on the drums. A loose wire on the drum may cause the winch to reverse itself by allowing the wire to bind and wind back in the wrong direction.
3. Inspect your equipment. Check the action of pawls, brakes, and clutches, making certain they are engaged. See that the clutch levers are locked in place. Note the amount of play in the brake pedal and make certain that there is not too much slack.
4. Test the winch. Energize the winch motor, disengage the pawl and lock it out. Release the parking brake and run the winch in both directions. With no load on the wire, have a man overhaul the wire when paying out or taking in on it.
5. To change speed gear, do three things: (a) engage the pawl and drum parking brake, (b) unlock gear shift lever and move the lever to a neutral position, and (c) slowly rotate the shaft in the hoist direction. Move the gear lever in the desired direction. When the gears engage, relock the lever. When ready in all respects, disengage the dog, lock it out, release the brake, and continue operations.
6. To use the gypsy heads, do three things: (a) set the drum parking brake and engage the pawl in the ratchet, (b) disengage the drum from the shaft, or shift the speed clutch to neutral and lock the lever in place; (c) move the control lever in the desired direction--remembering when securing a winch to lock the parking brake to prevent the wire from unspooling from the drum, and to engage the pawl in the ratchet. Secure the power. Winches in constant operation should be lubricated about <u>every four hours</u>.

Mooring lines hold a ship alongside a pier. The bow and stern lines are usually longer than the others and run directly from the bow and stern, respectively. Prior to mooring, all lines should be faked down so as to make them free for running near the chock through which they pass. Your bow line and forward springs prevent the ship from drifting astern. With steerway on, both these lines, if secured, tend to breast the ship in. The stern line and after springs prevent the ship from drifting away from the pier. When mooring lines are used for handling the ship in coming alongside, it is very important that they be gotten out as soon as possible, and that the orders from the person in charge be promptly and accurately obeyed. In these orders, the lines are referred to by numbers. The forward number being number one and the next going aft being number two, and so on. You may be told to hold, check, or keep slack in any of them; hold one, keep slack in two, check three, etc. When a line is checked it is payed out a little at a time. As the strain on it becomes more intense, you should check a line rather than let it part even without orders. You should watch your line carefully, foresee the fact that the strain is about to become dangerous, and inform the person in charge. Warning of a dangerous strain is given by the creaking of the line.

Fig. 5.20

Deck fittings are used in the mooring process. These deck fittings include the cleat, bitts, chocks, and the bollard on the pier.

Fig. 5.21

The cleat is a device consisting mainly of a pair of projecting horns and is used for belaying a line or wire. Bitts are cylindrical objects made of cast iron or steel. As a rule they are arranged in pairs. Each pair is mounted on a separate footing, which in turn is welded or bolted to the deck. Usually there is a set of bitts forward and one aft of each chock, used mainly for belaying mooring lines.

A chock is a heavy fitting with smooth surfaces through which mooring lines are led. Mooring lines are run from bitts on deck through chocks to bollards on the pier when a ship is mooring.

The bollard is a strong cylindrical upright on a pier. The eye or the bight of a ship's mooring line is thrown around the bollard.

5.3 Boat Seamanship

Ship Maintenance. Once on board, the deckhand spends a great deal of his time chipping, sealing, painting, soogeeing, washing down, or doing other maintenance jobs and any other job

aboard the ship. The fight to keep the vessel clean and to keep corrosion down is a continuous shipboard chore.

Cargo boats alongside rigs and platforms frequently get splattered with cement, mud, oil, and other materials. It is usually left up to the crew to scrub down the vessel. Salt-water spray leaves a heavy coating of salt deposits on the hull and superstructure that must be washed off with a deck-washdown hose, "milk-can" brushes, and powdered or liquid detergent. Inside paintwork is cleaned by the method known as soogee. That is, the object is washed with a heavy soap and water solution, and then wiped clean and dry with soft clean rags.

All bright work should be polished daily. A few minutes each day keeps the brass in shape, but if neglected it will corrode and require much more work to clean.

Painting helps reduce barnacles and other foulants, which reduce speed and use up more fuel. Most of the newer vessels have the hull and superstructure coated with some form of inorganic zinc. This coating process takes place at the shipyard during construction. The coating process has greatly reduced the maintenance of the vessels. A primer coat or two is applied over the coating of inorganic zinc, depending upon the desired thickness (in milligrams). After the primer coat sets, the top coats are applied. As paint is scuffed or scratched, the metal is exposed and rust begins. The area where rust forms must be cleaned down to the bare metal, then the protective coatings applied again. The tools, paint, and gear required to do this are on each boat or can be checked out from the port captain. Some of the hand tools used to scale rust are chipping hammers, needle guns, grinders, and sanders.

Fig. 5.22

There is a brush for almost every purpose, so be certain that you use the right brush and keep it in the best condition. Table 5.6 lists the various brushes and the general usage of the most frequently employed brushes in the painting of boats in the mineral and oil industry.

The two most useful brushes are the flat brush and the oval sash and trim brush. A skillful painter using a flat brush can paint almost anything aboard ship. Flat brushes are wide and thick and carry large quantities of paint to provide a maximum of brushing action. Sash brushes are handy for painting small items and those hard to get at places and for cutting in.

Most of the paints and protective coatings used on the exterior surfaces are epoxy and other synthetic bases. One must be certain to follow the directions for each type of paint (see Table 5.7).

Table 5.6. Types of brushes and their uses.

Flat paint brush	Large surfaces
Oval sash and trim brush	Small surfaces
Fitch brush	Small surfaces
Oval varnish brush	Rough work
Flat varnish brush	Medium work
French-bristle varnish brush	High-grade work
Lettering brush	Small surfaces
Lettering brush	Large work
Painter's dusters	Cleaning work

Table 5.7. Common paint spraying defects.

Defect	Appearance	Cause
Orange peel	Pebble texture; resembles orange peel	Improper thinner
Runs	Dropping effect	Using material that is too thin
Sags	Dropping effect	Using too much material
Pinholes	Bubbles after dry; leaves holes	Presence of water or excessive thinner
Blushing	Resembles a powdering of paint	Moisture on the surface that is being sprayed, or too much moisture in the air
Peeling	Falling off	Improper cleaning of the surface
Bleeding	Color discoloration	Occurs when the color of a previous coat discolors the finish coat

Sandblasting is used for big paint and rust-removing jobs. From time to time, the rust and corrosion catches up due to lack of work on the crew's part, or due to circumstances brought about by the nature of the work the vessel has been doing. The vessel is then brought to the point and a sandblasting rig is set up. The boat's crew may be used to blast the hull and deck. The protective coatings are then applied and the vessel is dressed out in a new top coat.

Oiling and greasing protect parts of the vessel's gear that cannot be painted. All moving parts of gear and equipment should be greased or oiled at regular intervals or when need is revealed by the parts freezing or not otherwise functioning as they should. An example of such moving parts are dogs and hinges on watertight doors and hatches. The chain binders used to secure cargo should be kept oiled and greased so that they may be used when needed. All deck machinery such as winches and anchor windlasses should be oiled.

Occasionally, the deckhand should get an oil can and grease gun and make a tour of the weather decks and oil or grease all gear, machinery, and apparatus that must be free to move, if it is to function properly. Saltwater corrosion and neglect will often combine to reveal sloppy seamanship.

The general cleanliness of the vessel and its working areas is the responsibility of the deckhand, and it is often referred to as housekeeping.

The seaman must keep his personal bunk neat, and he is responsible for emptying his own waste basket and ashtrays. There are provided, for the convenience of the seaman, containers in which the seaman can place matches, cigarettes, and used paper towels. The seaman is asked to keep ashes and cigarette butts from reaching the deck. Decks should be swept and swabbed down and polished and buffed where the deck-coating requires.

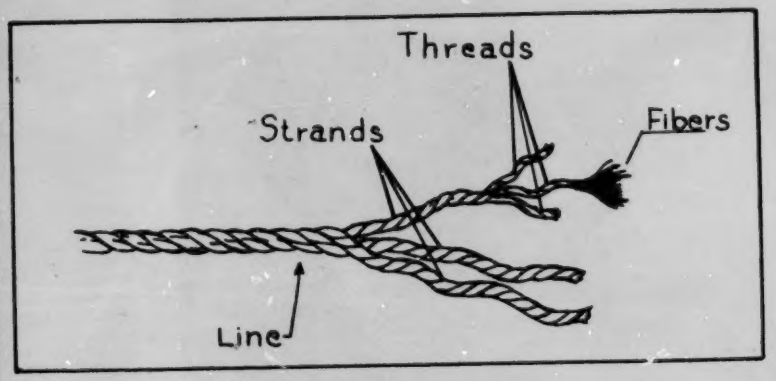


Fig. 5.1 The construction of line.

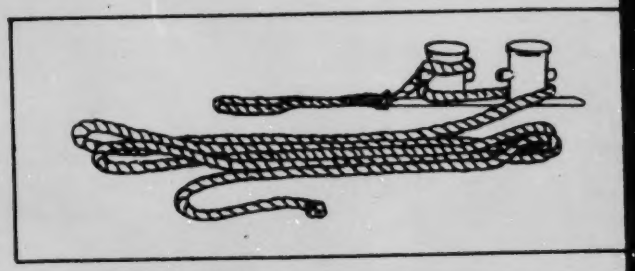


Fig. 5.3 Line faked down.

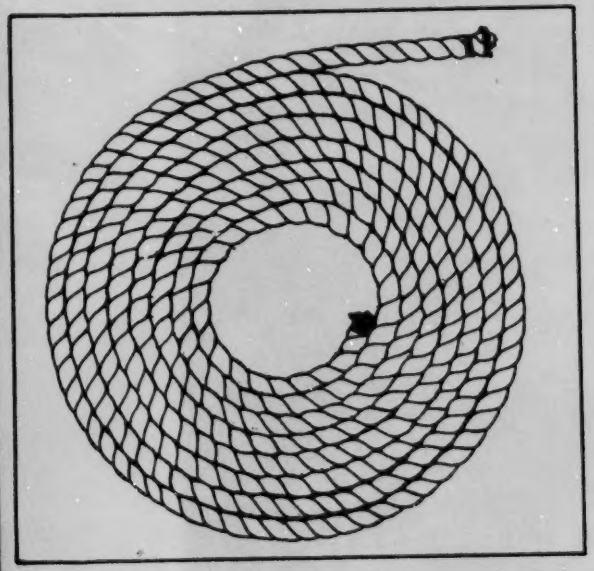
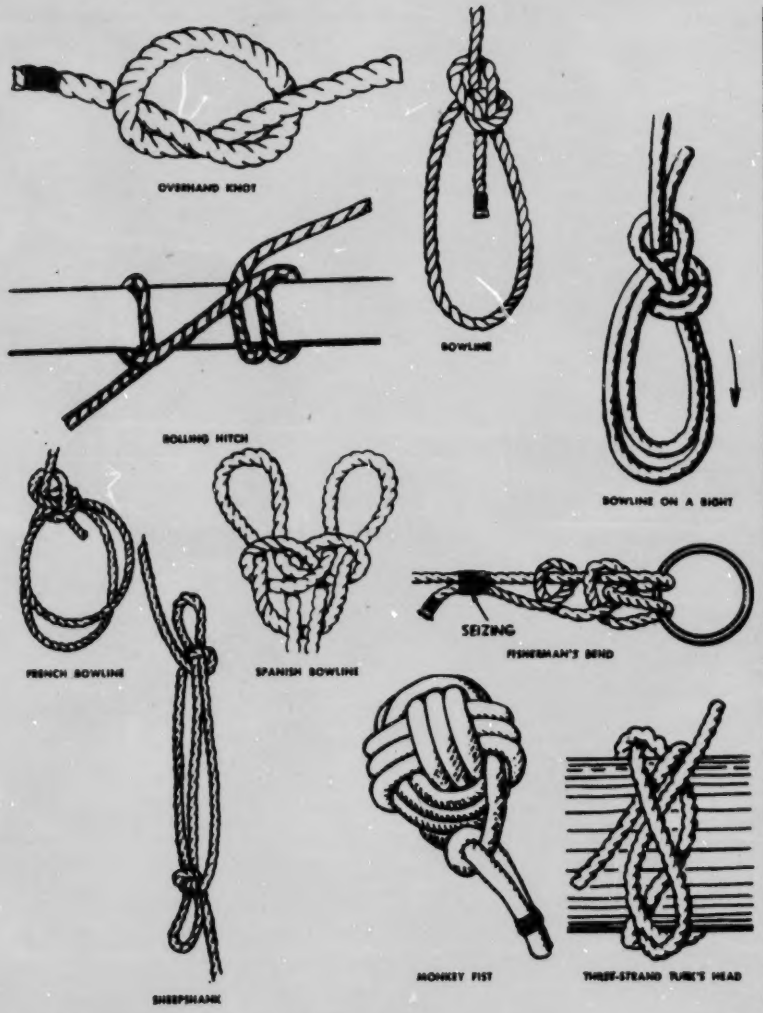


Fig. 5.2 Flemished line.

Fig. 5.4 Correct method of removing natural fiber line from coil.



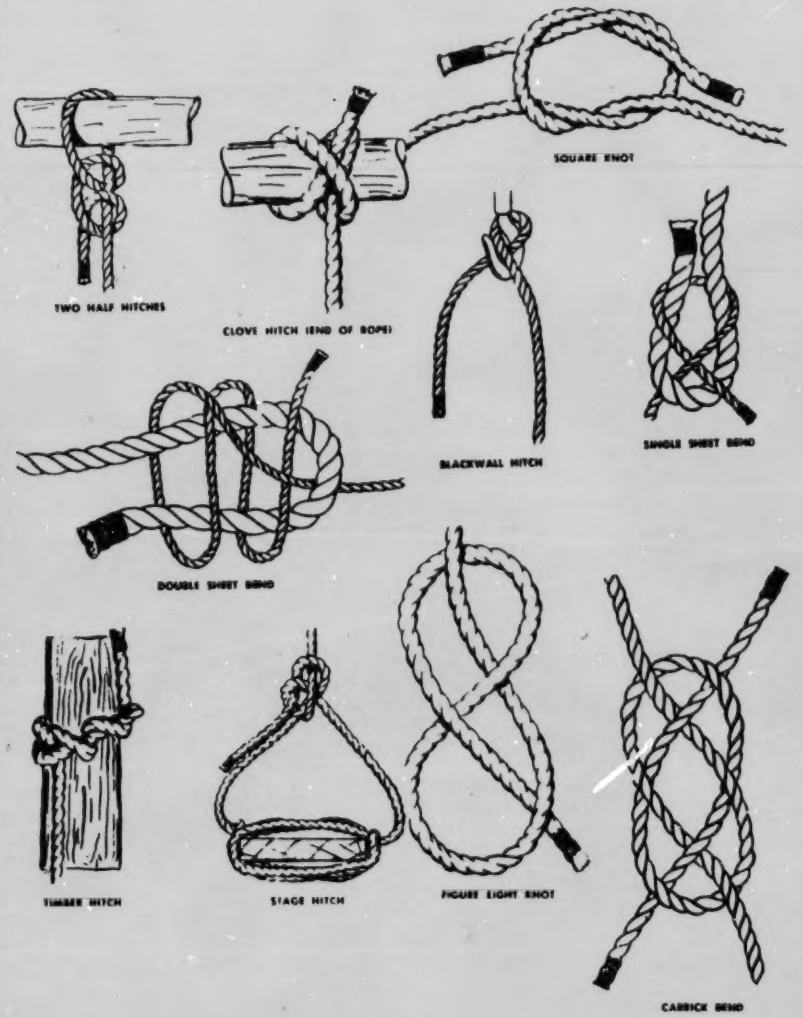


Fig. 5.5 (a,b) Common knots, bends and hitches.

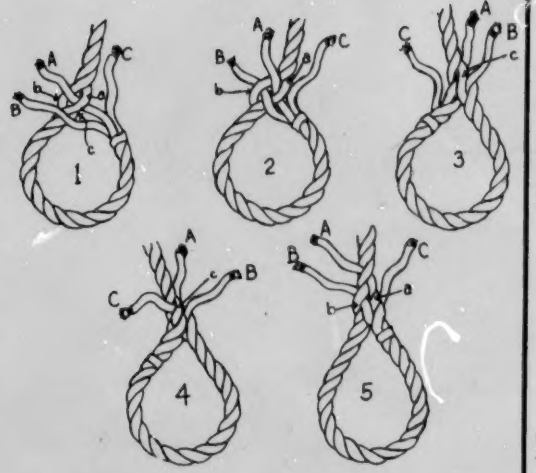


Fig. 5.6 Steps in making an eye splice.

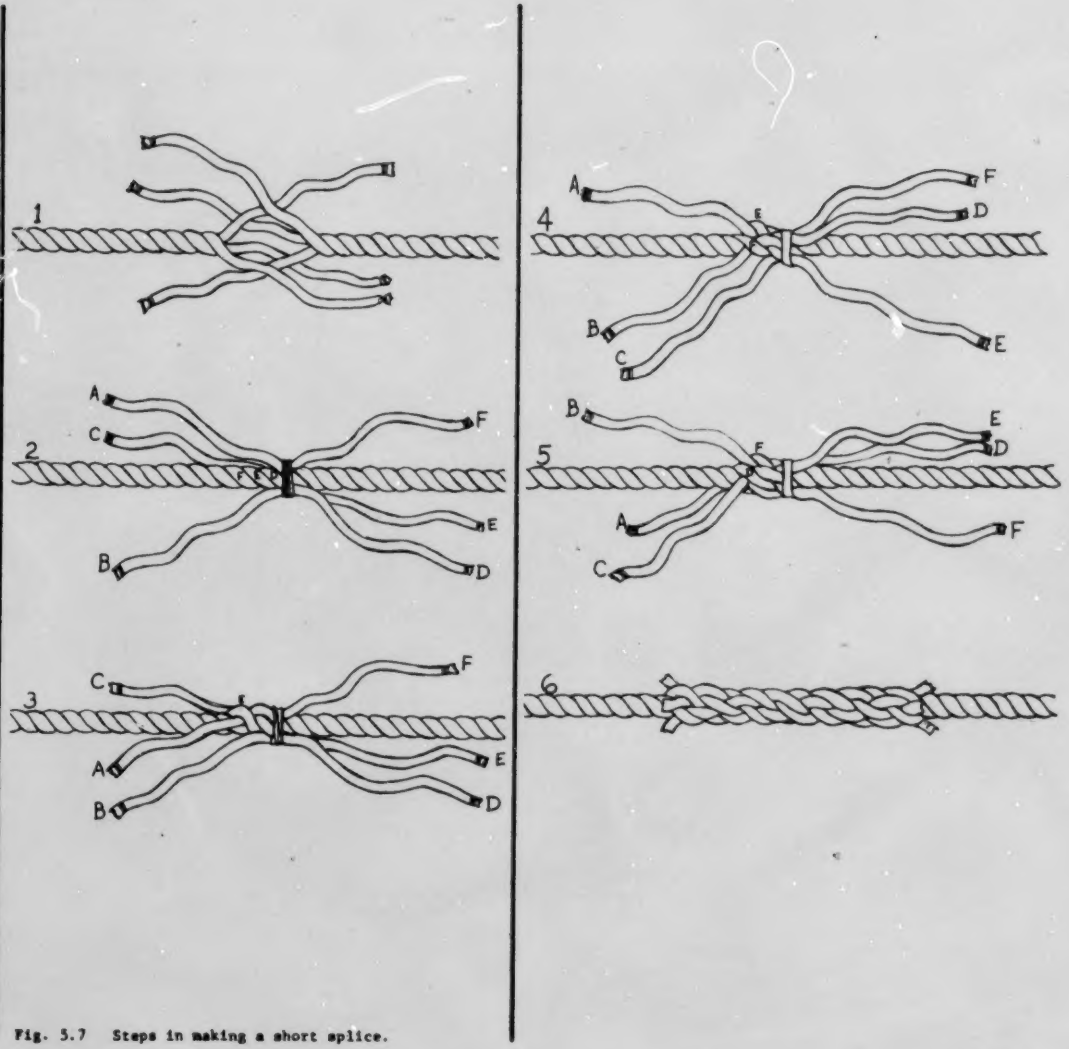


Fig. 5.7 Steps in making a short splice.

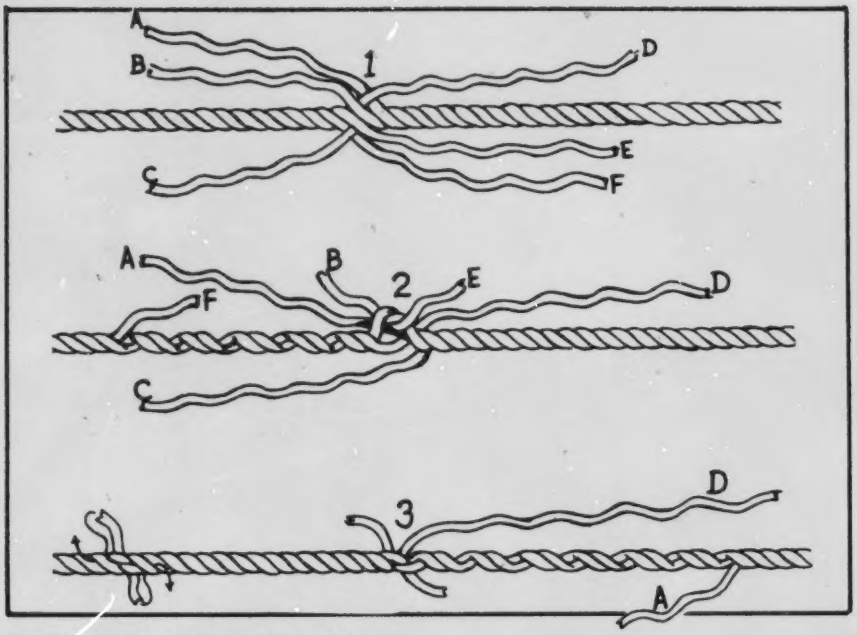


Fig. 5.6 Steps in making a long splice.

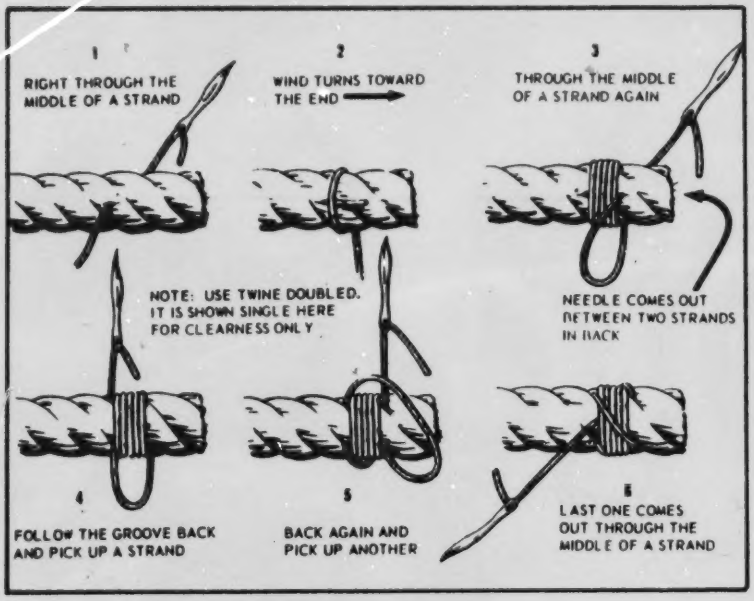

1
RIGHT THROUGH THE MIDDLE OF A STRAND
2
WIND TURNS TOWARD THE END
3
THROUGH THE MIDDLE OF A STRAND AGAIN
NOTE: USE TWINE DOUBLED. IT IS SHOWN SINGLE HERE FOR CLEARNESS ONLY
NEEDLE COMES OUT BETWEEN TWO STRANDS IN BACK
4
FOLLOW THE GROOVE BACK AND PICK UP A STRAND
5
BACK AGAIN AND PICK UP ANOTHER
6
LAST ONE COMES OUT THROUGH THE MIDDLE OF A STRAND

Fig. 5.9 Steps in putting a permanent whipping on a line.

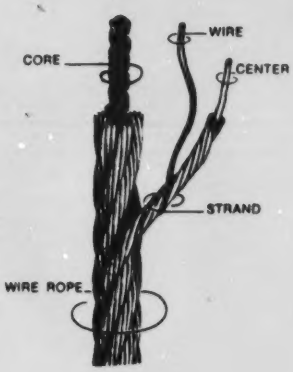


Fig. 5.10 The construction of wire rope.

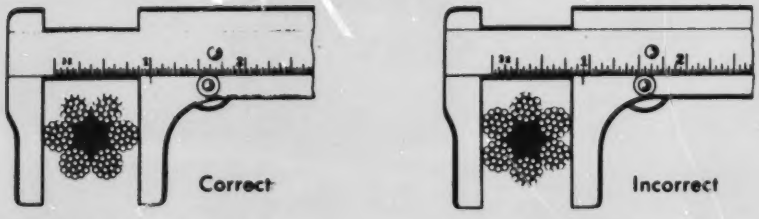


Fig. 5.11 Measuring wire rope.

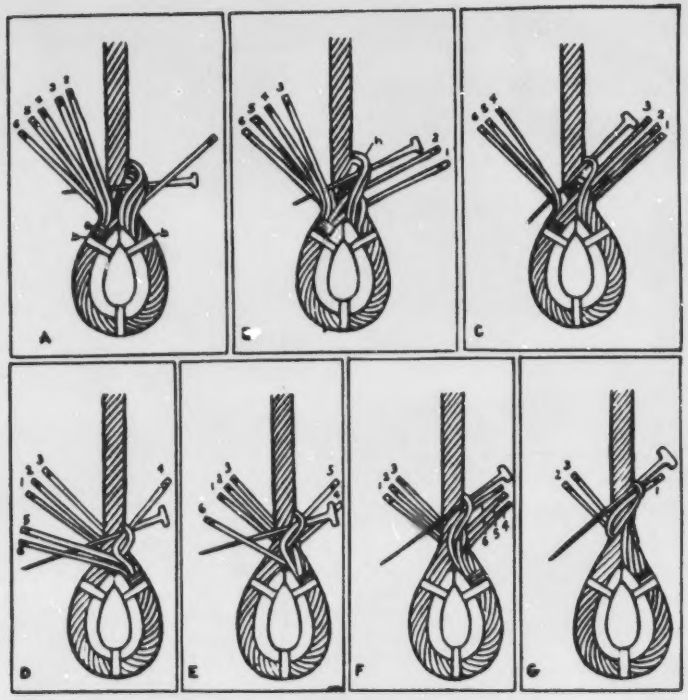


Fig. 5.12 Steps in making the Liverpool eye splice.

Steps in Making the Liverpool Eye Splice

1. Prior to making an eye splice in wire you must have certain tools available, including a vice, marlinspike, and seizing wire. In figure 5.12 a thimble has also been placed inside the bight.

2. Seize the thimble in the eye as shown at "b" in figure 5.12a. The rope should also be seized about one and one-half feet from its end. This end seizing is shown at "a".

3. Unlay all of the strands of the end of the rope back to the seizing. Then, seize the end of each strand.

4. Insert a marlinspike under three strands of the standing part of the rope and tuck strand 1 as shown in figure 5.12a.

5. Withdraw the spike and again insert it, this time picking up two strands of the standing part. Then tuck strand 2 as shown in figure 5.12b. Letter "h" represents the core of the rope.

6. Remove the marlinspike and reinsert it, this time picking up one strand, and tuck strand 3 as shown in figure 5.12c.

7. In figure 5.12d the splice has been turned completely over to more clearly explain the remaining steps. Therefore, strands 1, 2, and 3 now appear in back of the standing part of the rope.

8. Insert the spike under the next strand to the left of the strand under which strand 3 was tucked. Tuck strand 4 in alongside the spike. Figure 5.12d.

9. Now lift the next strand of the rope (figure 5.12e) and tuck strand 5 in alongside the spike. Follow the same procedure in tucking strand 6 (figure5.12f).

10. After all of the strands have been tucked, the work is continued by starting again with strand 1 and tucking it under the next strand of the rope.

11. The Liverpool splice is also known as the spiral splice because as you continue tucking the strands, what you are doing is tucking the strands around and around the strands in the standing part which they were previously tucked under.

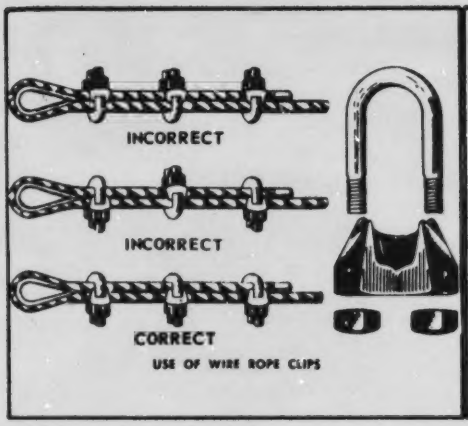


Fig. 5.13 Correct use of wire rope clips.

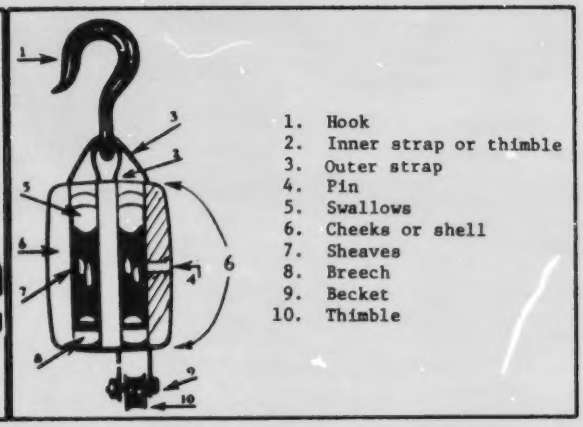


Fig. 5.14 Nomenclature of a block.

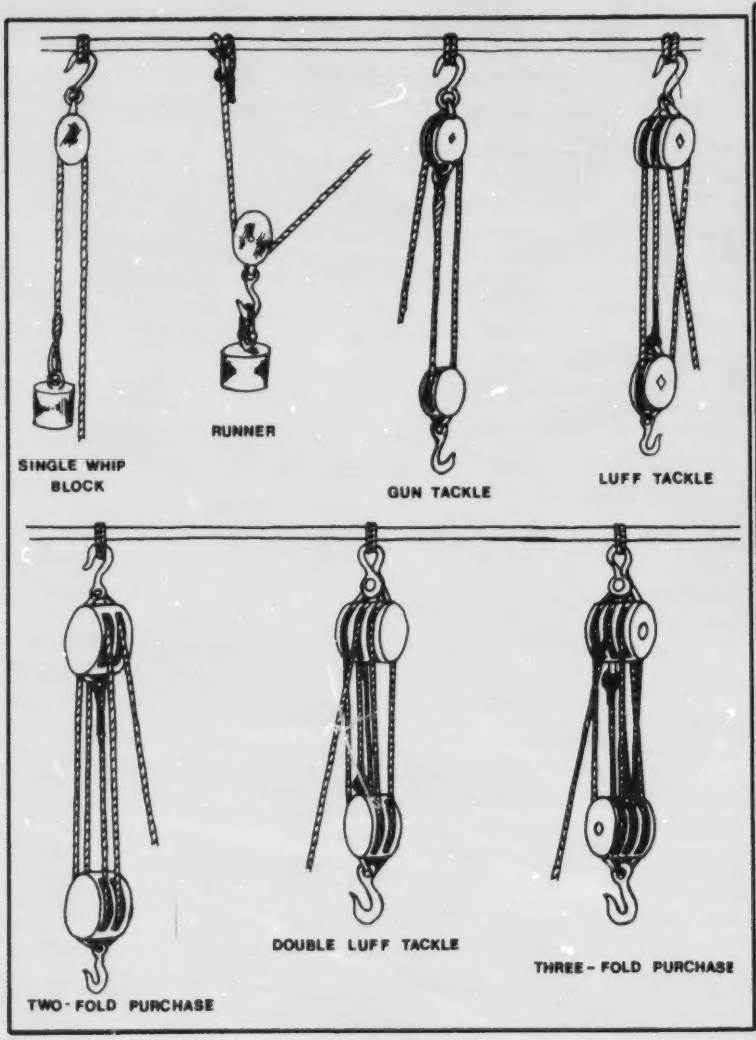


Fig. 5.15 Types of tackles.

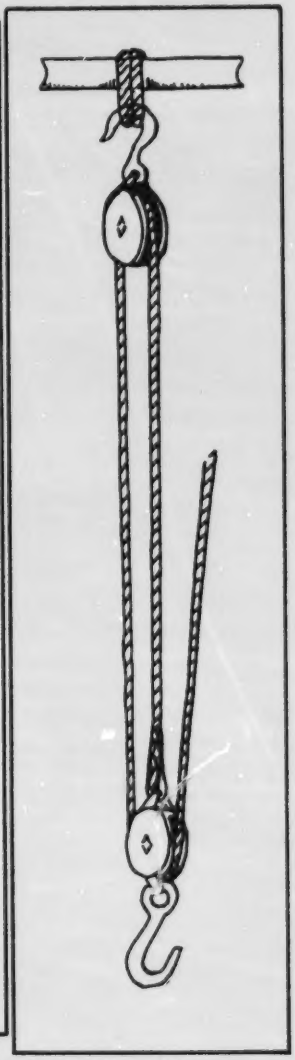


Fig. 5.16 Gun tackle rove to maximum advantage.

Fig. 5.17 Supply boat anchor in hawsepipe.

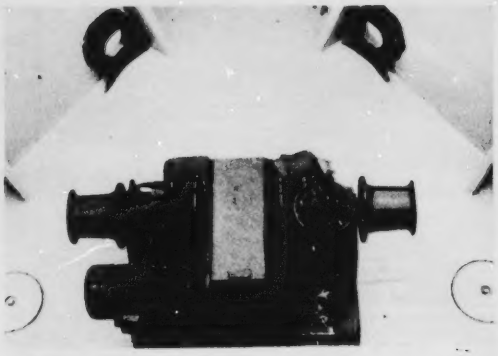


Fig. 5.18 Anchor windlass.

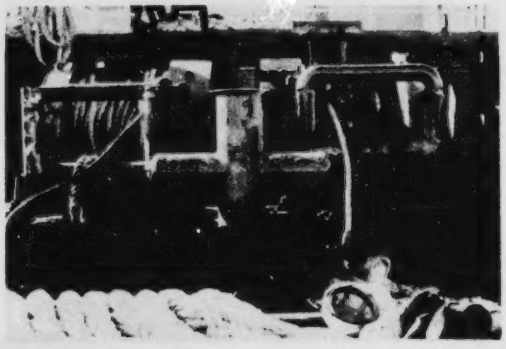


Fig. 5.19 Towing winch.

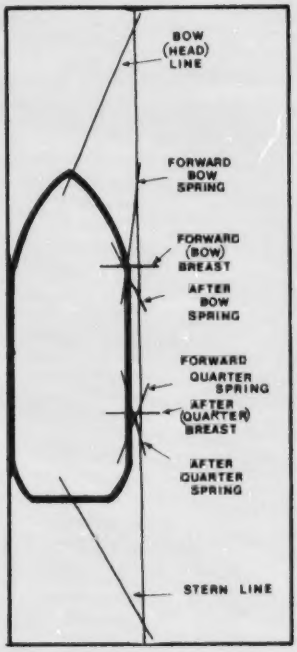


Fig. 5.20 Nomenclature of mooring lines.

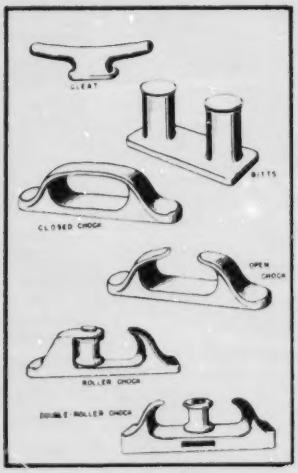


Fig. 5.21 Deck fittings.

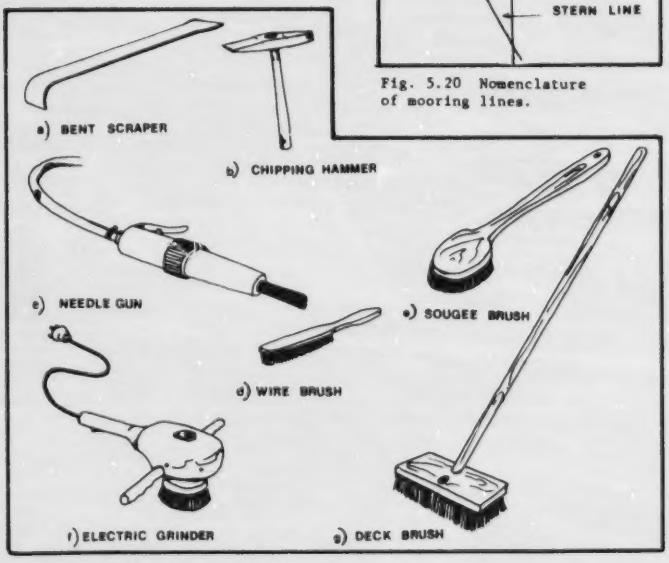


Fig. 5.22 Deck maintenance tools.

6. U.S. MARINE LAW AND REGULATIONS

6.1 Introduction

Rules governing the rights and duties of vessel, owner, crew, shipper, and passengers were developed long before recorded history. One of the oldest known body of laws concerns admiralty--the law of ships, seamen, the sea, and the transactions concerned with them. Marine insurance is one field of admiralty. It is also the oldest form of insurance. In the United States, the Constitution showed concern for maritime matters before the federal government was established. It gave federal courts jurisdiction "in all cases of admiralty and maritime jurisdiction" in Article III, Section 2. This, together with the Commerce Clause, gives the federal government authority to regulate the maritime industry.

The general welfare and national security of the United States is closely tied to the health and security of the maritime industry. Practically all of our overseas trade is conducted by vessels. A great deal of our domestic trade moves at low cost on our rivers and other waterways. The escalating requirements for energy, with diminishing supplies, has caused mineral exploration and exploitation to move off the coast and into deeper and deeper water. This activity has caused an explosion in demand for vessels to service the offshore industry. The crew boats, supply boats, tow boats, research vessels, and other specialized vessels of the "oil patch" are subject to laws and regulations written, in most cases, long ago for deep sea vessels.

The laws governing marine operations are found throughout U.S. statutes and in numerous international treaties. However, the most important for our purposes are: U.S. Code, Title 14--Coast Guard; Title 33--Navigation in Navigable Waters; and Title 46--Shipping. These laws either state definite requirements or give some government agency the authority to establish and enforce regulations. The regulations issued on the authority of the law have the same effect as law. Regulations are found in the Code of Federal Regulations, which is divided into titles. The following titles concern us:

Title 19 --Customs
Title 33 --Navigation and Navigable Waters
Title 46 --Shipping
Title 47 --Radio

Marine legislation is extensive. A Supreme Court Justice, after interpreting a section of admiralty, stated that it was a

"maze of legislation." This is the case. Most marine legislation resulted from casualties or other incidents. There has been no comprehensive effort to take conflicting and often ambiguous (unclear) language and unify it by codefying it into a single, simple body of law.

To understand how marine law came about, it is necessary to have some appreciation for its origin. In 1875, Congress undertook to compile or combine all laws that had been passed by the federal government up to that time. The marine laws in effect up to 1870 were combined as Title 52 of the Revised Statutes 4990-5500. The revised statutes are effective in and of themselves. All laws since that time are properly cited, for example, as "Public Law 93-102." The number of the public law is in two phases. A typical number would be 93-102, meaning the 102d law passed by the 93d Congress. However, in an attempt to make the laws easier to find, though it is an unofficial version, every new law is placed in what is known as the U.S. Code. Certain sections of the U.S. Code, known as Titles, have been enacted into positive law. However, none of the sections dealing with marine matters have been so acted upon. Reference to all laws in this chapter will be given as USC (the United States Code). When a law is passed, it first comes out in the official journal of the Congress of the United States, The Congressional Record.

Marine laws are among the many laws that do not state explicit requirements but rather delegate authority to some federal agency. The federal agency most often given authority in marine matters is the U.S. Coast Guard. When the Coast Guard issues regulations, implementing the provisions of the law, they are put in the Code of Federal Regulations, commonly known as CFR. Before becoming effective, the regulations must be published in another publication known as the Federal Register. Thus, often your first knowledge of what the regulations are will be contained in the Federal Register, which is published each working day. Often the regulations in printed form in the CFR will not come out for several months. The most extensive coverage of law and marine regulations that you, training as a vessel operator, will need to concern yourself with, is Title 46, CFR, dealing with shipping. Chapter I of this Title is administered by the US Coast Guard and concerns all the vessel inspection laws on everything from the equipment, drills, and such on the vessels themselves, to the licensing and manning of the vessel, pollution, and operations. In this section, we will be primarily concerned with the requirements of Title 46, Chapter I, issued by the US Coast Guard, which is divided into numerous sub-chapters as follows:

Sub-Chapter	Area
A	Procedures Applicable to the Public

	B	Licensing and Certification
	C	Uninspected Vessels
	D	Tank Vessels
	E	Load Lines
Fig.	F	Engineering
6.1	G	Documentation and Measurement
	H	Passenger Vessels
	I	Cargo and Miscellaneous Vessels
	J	Electrical Regulations
	K	Investigation and Suspension Proceedings
	L	Overtime for Coast Guard Employees
	M	Shipment of Bulk Grain Cargoes
	N	Dangerous Cargo
	O	Bulk Dangerous Cargo
	P	Manning
	Q	Specifications
	R	Nautical School Ships
	S	Numbering of Undocumented Vessels
	T	Passenger Vessels under 100 Gross Tons
	U	Oceanographic Vessels
	V	Special Purpose Vessels

6.2 Sub-Chapter T: Regulations

Rules and regulations for all small passenger vessels under 100 gross tons are in Title 46 Code of Federal Regulations, Chapter I Coast Guard, Sub-Chapter T, Rules and Regulations for Small Passenger Vessels, reprinted in Coast Guard Publication 323.

Sub-Chapter T is unique and will be used for the basis of this study of rules and regulations because it is the only sub-
Fig. chapter that contains complete regulations dealing with that
6.2 class of vessels (small passenger, under 100 gross tons). Parts 175, General Provisions, through 181, Fire Protection Equipment, are contained in the other sub-chapters dealing with different types of vessels. However, unlike the other sub-chapters, Sub-chapter T has a Part 182 (machinery installations); Part 183 (electrical system installations); Part 186 (manning); and Part 187 (licensing). These four general areas of the regulations are contained in separate sub-chapters for other vessels (cargo vessels, large passenger vessels, oceanographic vessels, mobile drilling units, and tankers) and will be discussed later in this section.

6.3 Part 175: General Provisions

6.3a Inspected Vessels. Table 175.05-1(a) is used to
Fig. determine under what sub-chapter of the regulations a vessel is
6.3 inspected. A quick look at this table will give an appreciation
a-c of the complexity of the laws that govern marine inspection. Column 1 gives the four methods of propulsion recognized by the law. Column 2 then gives the size or other limitations established within the propulsion type.

Virtually all of the vessels within the scope of this text are motor (including diesel) propelled. Column 2 then gives three size distinctions, breaking at 15 gross tons and 300 gross tons.

Columns 3 through 8 then break down the vessels by their operation. The heading of the column tells under what sub-chapter a vessel is inspected. Be sure when using this table to check the footnotes for the appropriate column. You will note that Column 4 covers vessels inspected under either Sub-chapter H, Passenger Vessels, or Sub-chapter T, Small Passenger Vessels. Footnote 4 (referenced in Column 4) reads: "Sub-chapter H of this chapter covers only those vessels of 100 gross tons or more."

Thus the table tells us that a vessel carrying more than six passengers, vessels carrying more than twelve passengers on an international voyage, and any vessel over 65 feet in length carrying any passengers, except documented cargo or tank vessels carrying up to sixteen persons in addition to the crew, are inspected under Sub-chapter T if under 100 gross tons or Sub-chapter H if 100 gross tons or more.

You will note that a tug or towboat under 300 gross tons falls under Column 6 and therefore is only subject to Sub-chapter C, Uninspected Vessels, and is not regularly inspected, but it may be boarded for checking in compliance with Sub-chapter C.

6.3b S (Small) and L (Large) Boats. Because of the ambiguity and the miscellaneous way the laws governing vessel inspection grew up, there is distinction made in these regulations whether or not the vessel is 65 feet in length. Vessels under 65 feet in length and under 100 gross tons are called "S" vessels, whereas those more than 65 feet in length and less than 100 gross tons are "L" vessels.

6.3c Gross Tonnage Criterion. Gross tonnage is used as the basic criterion to determine whether or not a vessel should meet certain requirements as to stability and such, however, when the Coast Guard Commandant determines that the gross registered tonnage is not a valid criteria for the invocation of safety requirements, he is required to notify the person in charge of the vessel as to what determination will be used and what regulation will be applicable to that passenger vessel.

6.3d Load Lines. All vessels more than 79 feet in length constructed since July 21, 1968, and that will be habitually engaged in international voyages are subject to load-line classification because the United States is signatory to the load-line treaty. Because of this international treaty the vessel is required to have a load-line if she is more than 79

feet in length, although she may not be subject to Sub-chapter T or may be inspected under any other sub-chapters, except C, Uninspected Vessels.

6.3e Definitions. Certain words have specific definitions in each sub-chapter. Normally in the general provisions portion of any sub-chapter you will find a list of special definitions to be used just within that sub-chapter. The following are used similarly in all sub-chapters:

APPROVED means approved by the Coast Guard Commandant, unless otherwise stated.

COASTWISE means not more than 20 nautical miles offshore in any ocean, the Gulf of Mexico, the Caribbean Sea, or the Gulf of Alaska.

COMMANDANT means Commandant of the Coast Guard.

COAST GUARD DISTRICT COMMANDER means any commander assigned as the commander of one of the geographical Coast Guard Districts.

HEADQUARTERS means Coast Guard Headquarters.

LENGTH in Sub-chapter T means the length measured from end to end over the deck, excluding sheer of that deck.

MARINE INSPECTOR is any officer assigned by the officer in charge of marine inspections.

OCEAN is any route more than 20 nautical miles offshore of any ocean, Gulf of Mexico, the Caribbean Sea, or the Gulf of Alaska.

OFFICER IN CHARGE OF MARINE INSPECTION (OCMI), is the officer assigned to conduct the duties of marine inspection for that particular inspection zone.

PASSENGER is any person other than the master or members of the crew.

PASSENGERS FOR HIRE means the carriage of any person or persons by a vessel for valuable consideration.

POWERHOUSE CONTROL means the operator of the vessel may start and stop the engines and control the direction of the vessel and speed of the propeller from the principle station from which the vessel is steered.

SAILING VESSEL means a vessel with no mechanical means of propulsion.

AUXILIARY SAILING VESSELS are capable of being propelled by mechanical means or sail.

For other terms it is always best to check the definition section of any particular sub-chapter to see if those terms have specific meanings.

6.3f Equivalents. Where the regulations require a specific piece or type of equipment the substitution of another piece of equipment that is deemed to be an equivalent is allowed. However, such substitution must be specifically approved by the Commandant.

6.3g Administrative Procedure. The regulations require written application for inspection to be made to the proper OCMI. However, in New Orleans this is normally done by calling the dispatcher who will send an inspector or make arrangements to send inspectors at a certain time and place. Upon that inspector's arrival, the inspector will give an application to the owner or his representative who then will fill it out and fulfill this particular part of the requirement. This form is CG 3752, Application for Inspection. If during the course of inspection the marine inspector notices any deficiencies or problems with the vessel he will point these out and discuss all requirements with the owner or his representative. He is then required to issue or pass to the owner a list of all such requirements that have not been complied with. This is normally accomplished by the issuance of what is called an 835, Merchant Marine Inspection Requirements. The 835 should contain a detailed statement of the deficiency. It will normally state the location of the regulation requiring repairs and will give a time limit for the repairs of equipment to be made.

6.3h Special Consideration. The OCMI is allowed to deviate from the regulations in the areas of construction, arrangement, watertight integrity, lifesaving equipment, fire-protection equipment, machinery insulation, electrical installation, and all vessel control and miscellaneous systems and equipment, when in his opinion special circumstances or arrangements warrant such departure from the regulations. As already stated, he may increase and go beyond the stated regulations when he feels that it is necessary for the safety of life and property.

6.3i Adoption of Standards and Specifications. Certain portions of industrial standards or specifications may be incorporated in their entirety. The most common of these are certain American Bureau of Shipping Rules and also the American Boat and Yacht Council and the Yacht Safety Bureau Standards. This adds these standards and specifications to the regulations that were specifically mentioned in another sub-chapter.

6.3j Sub-Chapter Q. At numerous points throughout the regulations specific equipment is mentioned. This is particularly

true in the area of lifesaving and fire-fighting gear where sub-chapter Q specifications are listed. Sub-chapter Q of Title 46 CFR deals specifically with certain detailed marine equipment such as life preservers, life rafts, etc., and sets Coast Guard specifications for this equipment.

All equipment manufactured under these specifications and for Coast Guard approval must be given specific approval by the Commandant. Notification regarding approval is published in the Federal Register and in the Coast Guard publication CG 190, Equipment List. Before buying equipment you should check the Equipment List to be sure that the specific piece of equipment is listed there, otherwise it may be rejected because it is not the approved type.

6.3k Appeals. It must be remembered that the inspector is no more than the eyes and ears of the OCMI who holds all the authority for rejection or approval of a specific vessel and the issuance or refusal to issue the Certificate of Inspection. Whenever any person directly interested in any decision of the OCMI feels aggravated or discriminated against, the decision or action may be appealed--first to the District Coast Guard Commander and, if satisfaction is not received there, to the Commandant.

In these appeal procedures, application for re-examination of the case by the District Commander or by the Commandant must be made within thirty days of the decision or action appealed. Naturally, if satisfaction is not obtained by or through the Commandant, the next recourse is to go into Federal Courts.

6.4 Part 176: Inspection and Certification

Fig. 6.4

When a vessel is required to be inspected, she must have on board at all times, as evidence of the compliance with the inspection requirements, a Certificate of Inspection.

6.4a When Required. An L vessel (one over 65 feet in length) must be in compliance with that certificate at all times. An S vessel (65 feet and under) when carrying more than 6 passengers on board or if over 15 gross tons and having freight on board, must be in compliance with the certificate. However, an S vessel in any other operation will be subject to the rules and laws governing the type of operation in which she is currently engaged. The Certificate of Inspection, Coast Guard Form CG 3753, is evidence that the vessel is complying with these regulations. After inspection has been conducted and passed this certificate is issued. However, due to the normal six-week delay between the completion of the inspection and the issuance of the Certificate of Inspection, the inspector often issues a

Fig. 6.5

Temporary Certificate of Inspection, CG 54, which is not as detailed in its description of the vessel. A temporary certificate

is valid for a limited period of time but must be carried on board and displayed in the same manner as the regular certificate.

6.4b Description. The certificate of inspection will describe the vessel, the route which she may travel, minimum manning requirements, the lifesaving equipment carried, minimum fire-extinguishing equipment, the life preservers required to be carried, maximum number of passengers, and the maximum number of persons who may be carried including the owner and operator, and such conditions of operations as may be determined by the OCMI.

6.4c Validity and Routes. A certificate of inspection issued to an S vessel is valid for a period of three years. A certificate issued to an L vessel is valid for a period of one year. A certificate may be revoked, suspended, or withdrawn by the OCMI at any time for non-compliance with the regulations.

The area of operation for that vessel will be described on the certificate under such major headings as Ocean; Coastwise; Great Lakes; Lakes, Bays, and Sounds; or Rivers, in order of the degree of danger. The OCMI may further limit the route allowed to operate.

A certificate will normally carry only the higher classification of routes allowed. This includes all waters below their certified route. For example, a vessel with a certificate for Lakes, Bays, and Sounds is also allowed to run Rivers.

You will find many vessels with certificates issued as "Oceans, Gulf of Mexico, not more than 100 miles off land" operating from South Louisiana. This designation is necessary because 'Ocean' begins twenty miles off land. But because the Gulf is relatively calm, the OCMI has determined through experience that the vessel designated is completely safe for operation in the Gulf of Mexico up to 100 miles offshore. The OCMI limits the vessel's operations to the Gulf of Mexico.

6.4d Passengers. The maximum number of passengers permitted is determined by the OCMI having jurisdiction over that particular vessel. The regulations allow three criteria for determining the number of passengers: the "length of rail" criterion permits one passenger for each 30 inches of rail space available to passengers at the vessel side and across the transom; the "deck area" criterion allows one passenger for each 10 square feet of deck area available for the passenger's general use, excluding certain spaces; the "fixed seating" criterion allows one passenger for each 18 inches of width of fixed seating provided.

The number of passengers may be further limited by the stability or subdivision considerations and any other consideration the OCMI may deem necessary. In New Orleans it is general

policy that crewboats operating offshore use only the fixed seating criterion. However, for inside waters and relatively protected waters like lakes, bays, and sounds. length of rail or deck area may be allowed. Offshore boats must use the fixed seating criterion.

Fig. 6.6

6.4e Amendments and Special Permits. A certificate changing or amending a valid certificate of inspection may be issued by the OCMI at any time. This Certificate of Inspection Amendment, Form CG 858, may be issued to authorize equipment changes or a change in the character of the vessel or passengers or freight allowed, or other similar change as specified on the certificate of inspection. This Certificate of Inspection Amendment forms a part of the certificate of inspection and should be kept posted under glass along with the Certificate of Inspection.

Two special certificates or permits should be mentioned here. If a vessel's certificate has been removed or has expired or is about to expire, the OCMI may issue a Permit to Proceed. This is properly called a Permit to Proceed to Another Port for Repair, CG 948. The purpose of this permit is to allow a one-way trip from one destination to another port to allow for certain things to be done. This permit will state upon its face the conditions under which it is issued and whether or not the vessel is permitted to carry freight or passengers during this trip. If the certificate is currently valid, the Certificate of Inspection will be forwarded to the destination port where the OCMI will return the certificate to the vessel upon completion of repairs.

6.4f Inspection for Certification. An inspection for certification is a prerequisite for a Certificate of Inspection and will only be done upon written application. The initial inspection for certification is done when the first certificate of inspection is issued; if the vessel has surrendered its Certificate of Inspection it may be placed under inspection again. In the case of a vessel being newly constructed or converted, the initial inspection will normally consist of a series of inspections during construction or conversion at the shipyard where this is being done. Subsequent inspections to receive a new certificate will normally be as complete an inspection as is necessary to ensure that the vessel's structure, piping, main and auxiliary machinery, electrical installation, and lifesaving, fire-fighting, and other equipment is in satisfactory condition and is fit for service. This inspection does not require that the vessel be drydocked.

Re-inspection is the term used to designate an inspection done between inspections for certification. Generally speaking, we can think of them as being an inspection done at least every year. Thus for a vessel whose certificate is issued only every

three years, there are two re-inspections between the periods when a certificate is issued. An L vessel whose new certificate is issued each year is not subject to re-inspections. A re-inspection spot checks the vessel to verify that she is safe. If suspicious or extenuating circumstances are found, the re-inspection can be as complete as an inspection for certification, but it is normally not that complete.

Fig. 6.7

6.4g Dry docking. Because the condition of a vessel's hull cannot be determined when afloat, if the inspection for certification or re-inspection is done at such times, the regulations also require that a vessel be inspected and given a dry docking or hauling-out periodically. Sub-chapter T boat regulations require that a vessel operating in salt water be dry-docked for inspection at least every 18 months. On the other extreme, a vessel operating exclusively in fresh water must be dry-docked for inspection at least every 5 years. Vessels that operate in salt water less than half the time in a 12-month period may extend this dry docking period to 36 months.

Most vessel owners take the opportunity to call for inspection anytime they dry dock. Thus the next government-required dry docking will extend from the date of the last dry-docking. Although you may have dry-docked 10 months ago, if you put in for repairs, you should call an inspector and have another dry dock inspection. Then the next required dry docking would extend from that day's date, rather than falling due 8 months from then. Regulations require you to dry dock periodically, and as you must do it now, it is best to get credit for the dry docking at the same time.

Basically a dry docking inspects all parts of the vessel's hull that could not be examined when the vessel is afloat, such as the underwater hull and all appendages, propeller, shaft, stern, bearings, rudder, thru-hull fillings, and sea valve strainers. The inspector may require drillings of the hull if he feels that the hull may be sufficiently worn or deteriorated. Sea chest or sea valve strainers may be required to be opened for internal examination.

6.4n Repairs and Alterations. Anytime a vessel has major repairs or alterations the OCMI should be notified so an inspection may be made. Plans or drawings of the alterations may be required because these things may change the safety factor, particularly the stability of the vessel. Repairs in kind, that is, replacing parts as they were before, do not require plans, however, the inspector should be present to verify that the vessel was repaired to its previous condition.

6.4i Material Inspections. Vessels are inspected for compliance with the standards of Sub-chapter T and additional

standards may be set beyond this sub-chapter by the OCMI. In application of inspection standards, consideration shall be given to the area of operation or other operational restrictions on the vessel. Published standards of recognized classification societies such as ABS and Lloyds and other recognized safety associations such as the National Fire Protection Association may be used as a guide, as long as these standards do not conflict with regulations.

Generally speaking the inspection will include a complete check of all portions of the hull available for inspection, all engineering systems, electrical systems, lifesaving equipment, fire extinguishing equipment, and all pressure vessels, steering apparatus, miscellaneous control systems, and equipment, and a sanitary inspection. Nothing in the regulations limits the marine inspector from making such test inspections as he deems necessary. The provisions of SOLAS 60 (Safety of Life at Sea Convention) will be covered in Sec. 6.22c.

6.5 Part 177: Construction and Arrangement

The owner of a vessel is required to submit plans and other information prior to the initial inspection of a new vessel to the OCMI for the zone where the vessel is being built. The OCMI may accept specifications, sketches, photographs, line-drawings, and written descriptions in lieu of plans normally required. He can also accept a design and construction of a vessel that is of a type personally known to him to be approved or to have a proven record of safe operation in similar service upon similar waters. Plan approval (for vessels under Sub-chapter T) is issued by the OCMI. However, if it is a vessel of less than 65 feet in length carrying more than 150 passengers, and all vessels over 65 feet, the builder or owner must submit plans for the approval of the Commandant, and two copies of each of the following: lines and offset, curves of form, capacity of tanks--including size and location in the vessel (in addition to the normal plan approval conducted by the OCMI). Additional calculation and data shall be submitted as necessary to determine the stability of the vessel. Plans need not be submitted for a sister vessel provided the owner of the plans authorized their use in the new construction.

6.5a Hull Structure. In general, compliance with the standards established by recognized classification societies will be considered satisfactory evidence of the structural adequacy of a vessel. For this purpose, Lloyd's Rule for the Construction and Classification of Composite and Steel Yachts is acceptable. The relatively new ABS Rules for vessels under 61 meters (200 feet) in length have some weight, although their newness makes them less valid than Lloyd's Rule.

Any vessel that is proven to have satisfactory scantlings and has performed satisfactorily for a period of five years in

a similar type operation for which a new vessel is designed may be given consideration and approval by the OCMI. Sub-chapter T boats carrying more than 150 passengers must be constructed to the fire standards of Sub-chapter H (Passenger Vessels). The general construction of the vessel shall be such as to minimize fire hazards, as far as is reasonable and practical. Newer vessels whose hulls, structural bulkheads, deck, or masthouse made of fibrous glass reinforced plastic, carrying 150 passengers or fewer, must be constructed with fire-retardant resins. Internal combustion engines, exhausts, boilers, galley uptakes, and similar sources of ignition or heat must be kept clear of and suitably insulated from any woodwork or other combustible matter. Paint, lamp, oil lockers and such compartments must be constructed of metal or lined with metal.

6.5b Means of Escape. All spaces normally accessible for passengers or where the crew may normally be quartered must be provided with at least two means of escape, one of which must be independent of watertight doors. There are minor exceptions to this rule.

6.5c Ventilation other than Machinery Spaces. All enclosed spaces must be properly vented or ventilated. Where such openings would endanger the vessel under adverse weather conditions, a means must be provided to close these vents. Proper ventilation for crew and passenger quarters must be suitable for the purpose of the space.

6.5d Crew and Passenger Accommodations. Vessels with crew who live aboard must be of reasonable size and construction for the facilities and services of the vessel.

Where seating is used to determine the maximum number of passengers, seats must be spaced so as to provide for easy escape in case of fire or other danger. Unless it can be shown that escape over the side can be made readily at the windows or other openings, aisles 15 feet or less in length must be at least 24 inches wide and aisles longer than 15 feet must be at least 30 inches wide. Distance from seat front to seat front must not be less than 30 inches where the seats are in rows. Where a vessel is operating on runs longer than 30 minutes, toilet and wash basins must be provided for the use of the passengers. On work boats, presuming only men are carried, 49 and fewer passengers--one toilet, no wash basins; more than 49 passengers--two toilets and one wash basin must be made available for the passengers. Regulations do provide specifications and limits for bunks for passenger use, however, very few boats in the workboat industry will have sleeping facilities for the passengers.

Main aisles leading to the exit from all passenger spaces must have at least 74 inches clear head room, and all aisles

must be kept clear of obstructions. Covered metal trash containers must be provided and the space so maintained as to minimize fire and safety hazards and to preserve sanitary conditions.

6.5e Rails and Guards. Rails or similar protection must be provided along the edges of the weather deck. Where limited space makes deck rails impractical, hand grabs may be substituted, as, for example, around the deckhouse. All rails, except as noted below, must be at least 36 inches high and must consist of evenly spaced courses not more than 12 inches apart.

If the vessel's normal operation requires the discharge of personnel in a seaway, these rails may be wholly or partially omitted or reduced in height to not less than 30 inches, in which case center rails or other suitable hand holds may be substituted. For vessels subject to the 1966 International Convention for Load Lines, the minimum height of these rails is 39 1/2 inches with the opening below the lowest course not more than 9 inches and at least 15 inches apart above that. However, the OCMI can allow an exemption or exception to this rule if it would interfere with the operation of the vessel. Storm rails or hand grabs must be installed in all passageways, decksides, and similar places where passengers or crew might normally have access. Suitable covers, guards, or rails must be installed in the way of all exposed and hazardous places and around gears and machinery.

6.6 Part 178: Watertight Integrity and Subdivision

To discuss watertight integrity and subdivision, we must first define or establish certain hull types and other minor definitions. The regulations in several instances mention the bulkhead deck, the uppermost deck to which all transverse watertight bulkheads extend vertically. Something is considered watertight within this part when it is so constructed as to effectively resist the passage of water, except a slight seepage, when subjected to a hose test with water pressure at 30 pounds per square inch through a 1 inch hose. A deck or bulkhead is weathertight when it is so constructed as to effectively resist the passage of water to any appreciable degree under continuous exposure to driving rain or high spray. The vast majority of vessels used in oil and mineral and towing industries are what is known as flush deck vessels. A vessel has a flush deck, or is considered flush deck, when there is a continuous weather deck located at the uppermost sheer line of the hull. In other words, the deck extends from the stem all the way to the transom and it is unbroken by any depression that could collect water. Many of the vessels in the scope of this book's coverage are flush deck, so our discussion of watertight integrity and subdivision will be limited to those rules applying to flush deck vessels. You should, however, be aware of the other types.

A vessel has a cockpit when there is an exposed recess in the weather deck of the vessel extending not more than one-half the length of the vessel. A cockpit that is more than one-half the length of the vessel is considered to be a well deck. A recess is considered to be exposed unless it is completely enclosed by superstructure that is seaworthy for the vessel's operating area. A vessel has a well deck when there is a weather deck fitted with solid bulwark around it that would stop the drainage of solid water over the side. Many supply boats and tugs are well decked. If the freeboard to this deck measured to the load water line is less than 10 inches, the vessel will be considered an open boat for the purposes of subdivision, stability, and drainage requirements. The best example of this type vessel is a Coast Guard 30 foot or 40 foot utility boat. An open boat is a vessel not protected from the entry of water into the hull such as a typical skiff. A vessel is on exposed waters when it is more than 20 miles from the mouth of the harbor of safe refuge. This is not to be confused with coastwise, which is within 20 miles of land. Exposed waters also include any waters where the OCMI determines that local sea conditions or weather are such as to create a special hazard.

Partially protected waters lie within 20 miles of the mouth of a harbor of safe refuge. Protected waters, in general, are waters of rivers, harbors, and sheltered lakes. There are no requirements for vessels less than 40 feet in length to have any bulkheads, if they carry fewer than 49 passengers. Vessels between 40 feet and 65 feet carrying fewer than 49 passengers must have a collision bulkhead if operating on oceans or coastwise. Vessels less than 65 feet in length carrying less than 49 passengers anywhere other than oceans and coastwise, are not required to have any bulkheads. S vessels (under 65 feet in length) carrying more than 49 passengers but not more than 150 passengers must have a collision bulkhead and may have sufficient air tankage or buoyancy to maintain a fully loaded vessel afloat with positive stability in a flooded condition. Instead of the air tankage or internal buoyancy, these vessels may be fitted with the one compartment subdivision required by vessels carrying more than 150 passengers or L vessels that require a collision bulkhead and one compartment subdivision, meaning that the fully loaded vessel will remain afloat with positive stability with any one main compartment completely flooded.

When a collision bulkhead is required it must be not less than 5 percent more than 15 percent of the waterline length aft of the stem. The collision bulkhead must be of substantial construction so that it will remain watertight with a head of water to the top of the bulkhead, which must extend to the weather deck. The collision bulkhead must never be fitted with a watertight door. An exception to this is the vessel not requiring one compartment subdivision--there may be an opening

not more than 12 inches between the top of the bulkhead and the underside of the weather deck if the remaining bulkhead is at least 36 inches deep. The location of watertight bulkheads is a matter of design. However, as an operator you should be aware of certain characteristics that must be maintained in a watertight bulkhead. The number of penetrations must be kept to a minimum, and they must be kept as high and as far inboard as is practical. This is a design characteristic; however, the regulation currently requires that satisfactory means must be provided for making such penetrations watertight. Therefore, electrical cables and such that pass through these bulkheads must be fitted with packing glands properly maintained to keep them watertight. Additionally, sluice valves, which drain an area simply by opening, are not permitted in watertight bulkheads.

6.6a Hatches and Coamings. The weather deck on flush-deck vessels must be watertight and have no obstruction to overboard drainage except that the weather deck may have solid bulwarks in the forward one-third of the vessel, provided such bulwarks do not form an enclosed space on all sides, and provided that the foredeck has sufficient sheer to ensure drainage aft. All hatches exposed to the weather must be of watertight construction. Hatches in watertight trunks that are 12 inches or more above the weather deck and hatches in cabin tops may be weathertight. As another exception, vessels operating on protected waters (meaning lakes, bays, and sounds, and rivers) may have hatches weathertight. Covers for all hatches on weather decks, trunks, or cabin trunks must be fitted with securing devices such as hinges and hasp-type arrangements or such other devices to prevent their coming adrift. These securing devices for spaces leading to living quarters or passenger accommodations must be of such a type that can be opened from either side, such as wedge-and-dog. Openings in deckhouses or companionways that give access into the hull must have permanent watertight coamings at least 6 inches high if operating on exposed or partially protected waters or at least 3 inches high on protected waters. This requirement is why you must always step up when going through a watertight door into the hull of the vessel or into the superstructure from the weather deck.

6.6b Hull Penetrations and Shell Connections. The number of openings in a vessel's side from the weather deck must be kept to a minimum. Port lights that open are allowed in a vessel's side under certain very special specified conditions. All inlets and discharges through the vessel's hull that are below the vessel's loaded waterline or within 6 inches of the vessel's waterline must be fitted with the shutoff valve on the interior of such hull penetration. This shutoff valve must be easily accessible for closing to prevent flooding in the event of piping failure. Engine exhausts that are led through the hull are not required to have such means of closure. Cast iron

hull connections or valves are not permitted. Cocks using cotterpins lacking a satisfactory or positive means of preventing the plug from becoming loose or removing the plug from the body when it is being operated are prohibited and may not be used. These shutoff valves must be located as close as possible to the hull in the way of intake or discharge piping and must be readily accessible. If not readily accessible, a positive means of closing these valves from the weather deck will be required, and such remote closing features must be labeled for identity together with the direction of closing.

6.7 Part 179: Stability

Part 179, Stability, applies to all L vessels (over 65 feet), all S vessels (under 65 feet) carrying more than 49 passengers, and other vessels whose stability is questioned by the OCMI; or where increased passengers beyond the normal criterion are allowed.

The above classes of vessels require a stability test requested by the owner, builder, or representative under the supervision of the Coast Guard. No Certificate of Inspection will be issued until satisfactory results are obtained from the stability tests. The OCMI may permit the waiver of a stability test where a sister vessel has previously been ascertained to be in compliance with these requirements, provided, of course, that the vessel currently being constructed will operate in no more severe service or at no deeper draft than that for which the sister vessel was originally tested.

Fig. 6.8

The Commandant may dispense with the stability test where it can be proved to his satisfaction that the vessel's stability can be determined without a test. The procedure for the conducting of a stability test is beyond the scope of this book, and furthermore, you as an operator will seldom if ever have occasion to witness or be a part of a stability test.

After a stability test has been conducted and the stability letter issued, the vessel must not be altered or converted in any manner that would adversely affect the stability. The OCMI must be notified in writing prior to the removal or relocating of any ballast or making any alteration that will increase the lateral surface area of the vessel, its draft, or changes in its vertical distribution of passenger spaces or weights on board. Every vessel subject to this part of the regulations must be issued a stability letter, which must be posted in the pilot house or kept on board the vessel in the custody of the operator when posting is impossible. The stability letter will indicate the conditions of operation under which the vessel will have satisfactory stability. Operating outside these conditions will bring the stability of the vessel below acceptable limits.

6.8 Part 180: Lifesaving Equipment

All lifesaving equipment aboard vessels subject to Sub-chapter T must be of an approved type. Notification of approval of certain equipment can be found in Coast Guard Publication CG 190, Equipment List. The specifications for lifesaving equipment to obtain this approval is found in Sub-chapter Q, which deals with specifications. Certain equipment that is not required, but that is carried on the vessel, may be allowed on the vessel if the Commandant, after suitable investigation, determines that it improves the safety of those on board. Special water-safety buoyant devices like work vests, in order to be approved, must be constructed in accordance with Sub-chapter Q. Such equipment may be carried as excess equipment but must not be computed in determining fulfillment of the requirements of the regulations.

By primary lifesaving equipment on Sub-chapter T boats, we are talking about life floats, buoyant apparatus, lifeboats, rescue boats, and life rafts. Primary lifesaving equipment does not include personal flotation devices such as life preservers and ring buoys. Sub-chapter T basically requires life floats or buoyant apparatus. The basic distinction between these two pieces of equipment is that the life float has a net inside that supports the people using it, whereas the buoyant apparatus must be hung onto, around the sides. Additionally, life floats must be equipped with two paddles.

Fig. 6.9 a-e

6.8a Primary Lifesaving Equipment Requirements. Vessels in ocean and coastwise service must have sufficient life floats for all persons on board. If in coastwise service, buoyant apparatus may be used in lieu of life floats. If the vessel's route is restricted to within 20 miles from a harbor of safe refuge, this requirement is reduced to sufficient equipment for 50 percent of all persons on board. Vessels operating not more than one mile from land may be operated with reduced equipment as specified by the OCMI. All life floats and buoyant apparatus must be white or international orange.

Vessels in river service must have sufficient life floats for at least 10 percent of all the persons on board; however, if operating not more than one mile from land, they are not required to have any.

Lifeboats or approved rigid life rafts may be substituted for life floats and buoyant apparatus but must be equipped and stowed as required by the OCMI. Suitable dingys, dories, skiffs, etc., may be substituted under the conditions set by the OCMI. Approved inflatable life rafts may be substituted for any portion of the primary lifesaving equipment.

6.8b Rescue Boat. When the OCMI deems that the vessel's design and operating characteristics are such that the vessel

will provide a satisfactory rescue platform, no rescue boat will be required. If the vessel itself will not accommodate itself to rescue work, and it is more than 65 feet in length, it shall be provided with a suitable rescue boat as determined by the OCMI.

6.8c Equipment for Primary Lifesaving Equipment. All buoyant apparatus must be equipped with a lifeline that is secured around the sides in bights of not more than 3 foot intervals and made of either floating material or with a seine float in each bight. This lifeline must have the size and strength of not less than 3/8 inch diameter manila line. An approved water light must be attached by a lanyard of 3/8 inch manila line, or its equivalent, at least 18 feet in length. Each unit must have a painter of 2 inch circumference line at least 24 feet long. Life floats, in addition to the equipment required of buoyant apparatus, must have two paddles each lashed along their sides.

6.8d Stowage. All primary lifesaving equipment must be stowed in such a manner as to be easily launched. Any equipment exceeding 400 pounds must be stowed so that it will not require lifting for launching such as on inclined skids. Primary lifesaving equipment must not be secured to the vessel except by lashing that may be easily slipped or by an approved hydraulic release.

6.8e Markings. All primary lifesaving equipment must be marked with the vessel's name and the number of persons allowed on each life float or buoyant apparatus in letters and numbers at least 1 1/2 inches high. Lifeboats and life rafts must be similarly marked with letters at least 2 inches high. Inflatable life rafts must be marked by the manufacturer, and no other marking is required.

6.8f Life Preservers. All life preservers must be of an approved type. Kapok and fibrous glass life preservers must have plastic covered pad inserts. Cork and balsa wood life preservers are acceptable provided they were manufactured prior to July 1, 1965, and have been on the boat since that time.

You must have a life preserver for all persons carried. In addition, unless the vessel carries adults only, life preservers for children must be provided equal to at least 10 percent of the total persons carried. Vessels on an international voyage must carry 5 percent more life preservers than the number of persons carried, if they have more than twelve passengers. Life preservers must be distributed throughout the upper part of the vessel in places convenient to persons on board and must be placed in containers so that they will float free if practical. Life preservers for children must be stored separately. All life preservers must be marked with the vessel's

name. If they are stored in a place that is not readily visible to passengers, the container in which they are stored must be marked with the words "Life Preservers" in letters at least 1 inch high.

6.8g Ring Buoys. All vessels under 65 feet must have at least one ring buoy of at least 24 inches diameter. All vessels 65 feet or over must be fitted with at least three ring buoys of 24 inches. A vessel that is allowed to operate at night must have at least one of the ring life buoys with an approved water light attached. In addition, one ring life buoy must have a line at least 60 feet in length attached to it. The ring life buoy with the water light must be located or stored at the location nearest the pilothouse. Vessels engaged in offshore petroleum operations are not permitted to carry water lights that utilize an open flame. Ring buoys used on a vessel on an international voyage must be orange in color.

6.8h Pyrotechnic Distress Signals. All distress signals must be of an approved type, and their service is limited to a period of three years from the date of manufacture, which will be found stamped on the distress signal. Every vessel must have at least six hand-held red flare distress signals and six hand-held orange smoke distress signals, or twelve combination flare and smoke distress signals. These distress signals must be stored in a portable watertight container.

6.9 Part 181: Fire Protection Equipment

Generally speaking, all equipment for firefighting must be of an approved type. Equipment that is installed but that is not required by these regulations must likewise be of an approved type unless the Commandant, after investigation and tests, determines that such equipment, although not approved, materially improves the safety of the vessel.

6.9a Power Fire Pumps. All vessels over 65 feet in length and all vessels under 65 feet used as a ferry or carrying more than 49 passengers must be equipped with a power-driven fire pump.

The S vessel fire pump must be self-priming and of such a size as to discharge an effective stream from a hose connected to the highest outlet.

The fire pump required on a vessel over 65 feet must have 50 gallons per minute capacity, with a pressure of not less than 60 pounds per square inch at the pump outlet. The pump outlet must be fitted with a pressure gage.

The pump may be driven off of one of the main propulsion engines in a twin engine installation. On a single engine

vessel, the pump must be driven off a source of power independent of the propulsion engine. This fire pump may also be connected to the bilge system so that it can serve as a fire pump or a bilge pump.

6.9b Hand Fire Pump. All vessels must have a hand-operated portable fire pump having a capacity of at least 5 gallons per minute. This pump must be equipped with suction and discharge hoses suitable for use in fire-fighting and may also serve as a bilge pump.

6.9c Fire-Main System. All piping, valves, and fittings in the fire-main system must be in accordance with good marine practice and suitable for the purposes intended. There must be a sufficient number of hydrants so that any part of the vessel may be reached with an effective stream of water from a single length of hose. Vessels over 65 feet must have a minimum of two fire hydrants. One length of fire hose must be provided and located at each fire hydrant required. All fittings on the fire hose must be brass, copper, or other corrosion-resistant material.

6.9d Fire Hose. Vessels under 65 feet in length may use commercial fire hose or good grade commercial garden hose of not less than 5/8 inch inside diameter. This garden hose shall be at least 25 feet long and not more than 50 feet in length. Where 1 1/2 inch fire hose is used, it must be good grade and provision must be made for storage without kinking. This firehose must be fitted with a good grade bronze or equivalent metal nozzle having at least a 1/2 inch solid stream orafice or an approved combination nozzle. Vessels over 65 feet must use 1 1/2 inch firehose of 50 foot lengths.

Fig. 6.10

6.9e Fixed Fire Extinguishing Systems. Fixed carbon dioxide fire extinguisher systems must be installed on all vessels using gasoline or other fuel having a flash point of 110°F or lower. Fixed fire extinguisher systems must also be installed in spaces such as paint and oil rooms and similar hazardous places on all vessels so equipped, and in cargo spaces that are inaccessible during a voyage and where combustible cargo is stowed. In the engine room this system is used to protect all spaces containing gasoline, machinery, and fuel tanks.

This fixed carbon dioxide system must be approved and installed to the satisfaction of the OCMI. If the space to be protected is of such a size that one portable or semi-portable extinguisher could completely flood the space with carbon dioxide gas, such extinguishers may be used if they are installed in a fixed position outside the space, if the applicator is in a fixed position so as to protect the space, and if the controls for the unit are outside the location to be protected.

6.9f Ferries and other Vessels Carrying Vehicles. Ferries and other vessels carrying vehicles are required to have a manual sprinkling system in the vehicular space. These requirements are contained in the applicable regulations in Part 76 of Sub-chapter H, Passenger Vessels.

6.9g Portable Fire Extinguishers. The number, type, and location of portable fire extinguishers required on each vessel is determined by the OCMI. All portable fire extinguishers must be of an approved type. In determining the portable fire extinguisher requirements, the OCMI is guided by Table 181.30-1(a); however, regulations allow him complete discretion in determining the exact extinguishers required.

The Coast Guard classifies portable extinguishers by a letter and a numeral. The letter tells the class of fire: a Class A fire is a fire in such things as wood, paper, or similar material; a class B fire is a fire in petroleum or combustible liquid; a Class C fire is a fire in electrical equipment. The number tells the size. Where a B-1 extinguisher is required, this could be a 1 1/4 gallon foam, or a 4 pound CO_2, or a 2 pound dry chemical extinguisher. Where a B-2 is required, this could be a 2 1/2 gallon foam, or a 15 pound CO_2, or a 10 pound dry chemical. Some extinguishers are not suitable for use on electrical (Class C) fires.

6.9h Fire Axe. All vessels over 65 feet in length must be equipped with one fire axe located in or near the pilothouse.

6.10 Part 182: Machinery Installation

Sub-chapter T contains requirements for the machinery installation on T boats, in a separate part unlike other sub-chapters. However, if the vessel under 100 gross tons is powered by steam or electrical systems for its main propulsion units, you must then go to Sub-chapter F (Marine Engineering) for steam installations, and Sub-chapter J (Electrical Engineering) for electrical installations. Also, any propelling machinery of an unusual type for small passenger vessels is given special consideration and is subject to requirements as determined by the OCMI. These unusual types of propulsion include, but are not limited to, gas turbine, outboard, air screws, and hydraulic jet engines.

6.10a Main Propulsion. Main propulsion machinery must be of a suitable type and design for the proposed propulsion requirements of the hull in which it is installed and must be capable of operating at constant marine load under such requirements without exceeding its design limitations.

6.10b Auxiliary Machinery. Only auxiliary machinery of the internal combustion piston type is covered by Part 182.

Steam or gas turbine auxiliary machinery is covered by Sub-chapter F and requirements set by the OCMI. Auxiliary boilers and heating boilers likewise are covered by Sub-chapter F, except that heating boilers must be tested or examined only every three years. All unfired pressure vessels (such as air tanks) must be Coast Guard approved and installed to the satisfaction of the OCMI. The requirements for design, construction, and testing of such approved unfired pressure vessels are likewise found in Sub-chapter F.

6.10c Gasoline Machinery. There is a misconception among many people that gasoline-powered boats are not allowed in the offshore extractive and towing industries. This is not true for Sub-chapter T boats; Part 182 sets down very rigid requirements for their use.

6.10d Machinery Using Diesel Fuel. This sub-part of the regulations deals with main propulsion and internal combustion, piston type auxiliary machinery that uses diesel fuel or other fuel having a flash point of over 110°F.

Fig. 6.11

All spark-producing devices such as generators and starting motors must be as high above the bilges as practical. Gages to indicate engine cooling water discharge temperatures and lubricating oil pressure must be provided for all propulsion engines. These gages must be located at the station from which the vessel is primarily steered.

6.10e Engine Cooling. Air-cooled propulsion and auxiliary engines may be installed, but as they are extremely rare they will not be covered here. Auxiliary engines with self-contained fuel systems may be air cooled when they are installed on open decks.

Water is far and away the most common engine coolant. The regulations require a water cooled engine to have the engine head, block, and exhaust manifold water-jacketed and the cooling water pump to be operated anytime the main engine is operated. This is normally accomplished by driving the cooling water pump directly off the engine. Air cooled radiators are not allowed on the main propulsion engine cooling system. A closed fresh water system utilizing keel coolers or heat exchangers is the most common method of cooling. Where a heat exchanger is used, a suitable hull strainer must be installed in the circulating water intake line.

6.10f Exhaust Cooling. Engine exhaust pipes are normally water cooled by injecting water into the exhaust immediately aft of the exhaust manifold. This water may be obtained from the engine-cooling water system or a separate engine-driven pump. Any section of the exhaust piping between the point of cooling water injection and the engine manifold must be either water jacketed or effectively insulated. The exhaust pipes on

air-cooled engines do not have to be water cooled but must be suitably insulated. Suitable insulation is also required on dry pipe vertical exhaust. Horizontal dry exhaust pipes are permitted only if they do not pass through living or berthing quarters, terminate above the deepest load waterline, are suitably protected to prevent the entry of cold water from rough or boarding seas, and are constructed of corrosion-resistant material at the hull penetration. A warning device must be installed if exhaust cooling is separate from the engine cooling system.

6.10g Exhaust Pipe Installation. Exhaust piping must be gas tight throughout and properly supported by non-combustible hangers or blocks. Exhaust piping must be led to the atmosphere with a number of bends or elbows and so arranged as to not allow backflow of water to reach the engine exhaust ports under normal conditions. A section of flexible metallic hose may be used. Non-metallic hose specially adapted to resist the action of oil, acid, and heat may be used provided its wall thickness is sufficient to prevent collapsing or panting. Exhaust piping passing through watertight bulkheads must make provision for the integrity of the bulkhead by the use of a non-combustible packing used in a bulkhead penetration gland. Water-cooled exhaust pipes may be welded to steel bulkheads if arrangements for relieving of stress are provided. Non-watertight bulkheads must have a suitable packing gland or a minimum clearance of 2 inches.

Vertical exhaust systems must be provided with spark arrestors that must be supported by suitable steel hangers and lagged with fire-resistant material. A minimum clearance of 9 inches must be maintained between this arrestor and any woodwork. Protective gratings or guards must surround exhaust pipes where there is a danger of personal injury. The exhaust pipe must be accessible throughout its length. Exhaust installations with pressures in excess of 15 pounds per square inch or running through living or working spaces must meet the requirements of Sub-chapter F.

6.10h Fuel Tanks. Fuel tanks built into the hull are allowed on steel, aluminum, and fibrous glass vessels, if built and installed to the satisfaction of the OCMI who may use the standards of a recognized classification society to determine the structural strength of these tanks. A new integral fuel tank must be subjected to a hydrostatic test of 5 pounds per square inch, or the maximum head (pressure) that may be applied to that tank, whichever is the greater. Fuel tanks that are built independent of the hull must be built of materials and construction as contained in Sub-chapter T.

Consideration will be given to other materials than those given that provide equivalent safety, if they meet the testing

requirements of the Yacht Safety Bureau. Fuel tanks are not allowed to have flanged top edges that may trap and hold moisture. All openings for fill pipes, ventpipes, and fluid level gages must be on the top surface of the tank. Tanks must have no openings in the bottom sides or ends except the fuel supply piping and an opening fitted with a threaded plug or cap that may be on the bottom of the tank for cleaning purposes. All tank joints must be welded; riveted fuel tanks are not allowed. Nozzles, flanges, or other fittings for pipe connections must be welded or braised to the tanks. Tank openings for pipe connections must be properly reinforced where necessary for the strength of the tank. Liquid level indicating gages must be of heat-resistant material, adequately protected from mechanical damage and provided with tank connections that will automatically close in the event of rupture or failure of the gage or gage lines. All tanks exceeding 30 inches in any horizontal connection must be fitted with vertical baffle plates. These baffle plates must be of the same material and not less than the minimum thickness required in the tank walls and must be welded or braised. Limber holes in the bottom and air holes in the top of all baffles are required. Galvanized iron or steel on the interior is not allowed. Galvanizing, painting, or other suitable coating must be used to protect the outside of these tanks. Fuel tanks must be located inside of or as close as practical to the engine provided they are installed so as to permit examination, testing, or removal for cleaning without disturbing the hull structure. They must be installed so they are adequately supported and braced against movement and must be insulated from contact between metal surfaces with a non-abrasive non-absorbant material. Wood is commonly used for such bracing and support. Fuel tanks must be electrically bonded to the common ground of the vessel. Cylindrical tanks should have the longitudinal seams as near the top of the tank as possible. Prior to being installed in a vessel, tanks must be tested to withstand the pressure of 5 pounds per square inch or 1 1/2 times the maximum head to which it may be subjected in service, whichever is greater. This is only true where the tanks are vented to the atmosphere. A stand pipe of 11 1/2 feet attached to the tank filled with water will accomplish the 5 pounds per square inch test. Water pressure that results in permanent deformations of the tank but does not result in leakage is not cause for rejection of the tank. After installation tanks must be tested once again to a head equal to at least that to which it may be subjected in service. The fuel may be used for this test rather than water.

6.10i Fill and Sounding Pipes. Fill pipes must be not less than 1 1/2 inches nominal pipe size and so arranged that overflow of liquid or vapor will discharge overboard, although with today's pollution regulations there is some question as to the propriety of this regulation. The intent is that the overflow will not escape into the vessel's hull but should be

caught on deck. Sounding pipes to determine the level of fuel may be omitted where soundings can be taken through the fuel pipe, or where marine fuel gages are installed. If sounding pipes are used, their openings must be at least as high as the opening of the fill pipe and they must be kept closed at all times except during soundings. Fill and sounding pipes should run as straight as possible, terminate on the weather deck, and be suitably marked for identification. Where a flexible fill pipe section is necessary, tubing or hose having a high resistance to petroleum or salt water, oils, heat, and vibration may be used; however, such hose must overlap the metallic pipe ends at least 1 1/2 times the pipe diameter and must be secured at each end with clamps of corrosion-resistant material. Flexible sections must be accessible and as near the upper end of the filling pipe as practical, and, if non-conductive, electricity must be electrically bonded across the flexible section for protection against static spark when filling.

Fig. 6.12

6.10j Diesel Fuel Tank Vents. Each tank must have a vent that will be connected to the tank at its highest point. The minimum net cross-sectional area of the vent pipe must be at least the cross-sectional area of 5/8 inch outside diameter tubing if the fill pipe terminates at the top of the tank; not less than the cross-sectional area of 3/4 inch tubing if the fill pipe extends into the tank, and not less than the cross-sectional area of the fill pipe if provision is made to fill the tank under pressure. The discharge of the vent must terminate on the hull exterior as high above the waterline as practical and away from any hull openings or in goosenecks as high above the weather deck as practical. The discharge ends of these vent pipes must be fitted with removable flame screens or flame arrestors that must consist of a single screen of corrosion-resistant wire of at least 30 x 30 mesh and be fixed so that it has a net open area at least equal to the cross-sectional area of the vent pipe.

6.10k Fuel Supply Line. Fuel supply lines must be of copper, nickel-copper, or copper-nickel, and have a minimum wall thickness of 0.035; other materials that provide equivalent safety may be used. Flexible hose is allowed if it is fitted with suitable connections and has a high resistance to salt water, petroleum, oil, and vibration. Flexible hose, if used, must be placed where it is easily seen and accessible, and it must not penetrate watertight bulkheads. Tubing connections and fittings must be drawn or forged metal of the flared type, except that flareless fittings of the non-bite type may be used when tubing is steel, nickel-copper, or copper-nickel. Tubing must be annealed before flaring. Cocks are prohibited from use in fuel lines except those of the solid bottom type with tapered plugs and union bonnets. The fuel line must be connected to the fuel tank at or near the bottom, be accessible, protected from mechanical injury, and efficiently secured against excessive

movement and vibration. Fuel lines that pass through bulkheads must be protected by close fitting ferrules or stuffing boxes. Shutoff valves must be provided at the tank and at the engine. The shutoff valve at the tank must be operable from outside the tank compartment, preferably from the weather deck. A loop of tubing or a short length of flexible hose must be installed in the fuel supply line at or near the engine to allow for vibration. A fuel filter or strainer must be provided. Drip pans and flame screens may be required under fuel strainers if not mounted on the engine. All accessories and the fuel line must be independently supported. Water traps with valves for removing water or other impurities are permitted if they are provided with plugs or caps to prevent fuel leakage.

6.10ℓ Ventilation of Diesel Machinery Spaces. Spaces containing machinery must be fitted with adequate drip-proof ventilators, trunks, louvers, or other suitable devices to provide sufficient air for proper operation in the main and auxiliary engines. A minimum of two ducts must be provided. One must extend to a point near the bottom of the compartment, so installed that the ordinary collection of water in the bilge will not trap the duct. Where forced ventilation is used, the duct extending near the bottom must be the exhaust. Total inlet and outlet area must be at least one square inch for each foot of beam of the vessel. These minimum areas are increased where the ducts also supply air for engines. The ducts must be of rigid permanent construction of fireproof material and be reasonably gas tight from end to end. They must extend as directly as possible and be properly fastened and supported. Ducts in a natural ventilation system must be fitted with cowls or scoops and have a free area not less than twice the required duct area. Where the cowls or scoops are screened, the mouth area must be increased to compensate for the area of the screen wire. Dampers must not be fitted in supply ducts. Cowls or scoops must be kept open at all times except when the safety of the vessel is involved. Supply and exhaust openings must not be located where the natural flow of air is restricted or adjacent to possible sources of vapor such as vents, fill lines, and sounding pipes, nor shall they be located where exhaust from the engine could be taken into the supply ducts--remember carbon monoxide.

Fig. 6.13

6.10m Ventilation of Compartments Containing Fuel Tanks. Enclosed compartments or spaces containing fuel tanks and no machinery must have a gooseneck vent of not less than 2 1/2 inches diameter.

Vent openings must be located free from possible sources of vapor ignition. In small compartments this vent may be reduced to 1 1/2 inches. Compartments with other ventilation need not have such vents.

6.10n Bilge and Ballast Systems. All vessels must be provided with a method to drain any watertight compartment other than a small buoyancy compartment. Sluice valves are not permitted in watertight bulkheads. Vessels 26 feet long and over must have individual bilge lines and individual suctions for each watertight compartment, except spaces forward of the collision bulkhead if this space may be pumped out with the use of a hand portable bilge pump that is on board.

The bilge line on vessels under 65 feet long must be at least 1 inch nominal pipe size; vessels over 65 feet must be at least 1 1/2 inches. Bilge suctions must be fitted with strainers with an open area not less than three times the area of the bilge pipe. The bilge suction lines must lead to a central control point or manifold. Each line must have a stop valve at this point and in addition, should have a check valve at some accessible point in the bilge line. A stop check valve is allowed. If the bilge line is fitted forward of the collision bulkhead, the bilge line must be fitted with a screw-down valve located on the forward side of the collision bulkhead that may be operated from above the weather deck; or you may use a screw-down valve without a reach rod on the aft side of the collision bulkhead, if it is readily accessible under all normal operating conditions.

The following bilge pumps must be provided:

Vessels over 65 feet: two fixed power pumps with a capacity of 50 gallons per minute each;

Vessels under 65 feet carrying more than 49 passengers and all small ferry vessels: one fixed power pump of 25 gallons per minute capacity and one portable hand pump of 5 gallons per minute capacity;

Vessels under 65 feet but over 26 feet: one fixed pump, either hand or power, with a capacity of 10 gallons per minute and one portable hand pump with a capacity of 5 gallons per minute;

Vessels under 26 feet: only a portable hand pump of 5 gallons per minute capacity.

The fixed power pump required may be driven off the main engine. It must be permanently connected to the bilge manifold or central control point, and it may also be connected to the fire main. If of sufficient capacity, the bilge pump may also serve as the fire pump. The pumps must be self-priming. Where two fixed power pumps are required, each shall be driven from different sources of power. Where a fixed hand bilge pump is required it shall be permanently connected to the bilge main and may also be on the fire main. The portable hand pump must

have a suitable hose on the suction and discharge end. This pump may also serve as a portable fire pump, if of sufficient capacity.

6.10o Ballast Systems. Ballast systems must meet the requirements of the OCMI. Ballast piping is not allowed in wooden vessels where the hull compartment is used for ballast. If carriage of liquid ballast is necessary, independent tanks must be provided.

6.10p Steering Apparatus. Vessels must have an acceptable steering system. Vessels in ocean and coastwise service must have an auxiliary steering system located above the weather deck. A hand tiller is acceptable for this purpose. On twin screw vessels the twin screws are considered as the alternate means of steering and therefore another system is not necessary. Vessels that are not fitted with a rudder and tiller as a normal means of steering do not require an alternate method.

6.10q Segregation of Spaces. Machinery and fuel tank spaces should be separated from accomodation and passenger spaces by watertight and vapor-tight bulkheads. Where segregation can be obtained by means of watertight and vapor-tight engine boxes, this is acceptable.

6.10r Non-Metallic Piping Materials. When rigid, non-metallic, basically plastic material is permitted and used, the following restrictions apply: penetration of watertight decks and bulkheads by rigid plastic is prohibited except where such penetration is accomplished by an acceptable metallic fitting and there is a metallic shutoff valve installed in this metallic penetration.

This valve must be operable from above the bulkhead deck. If two valves are installed, one on either side of the bulkhead, the valves need not be remotely operated, provided immediate access to both is possible. Where both plastic and metallic pipes are used in the bulkhead penetration, and where the two materials exist entirely on opposite sides of the bulkhead, the required shutoff valve must be on the metallic part of the system and may be locally operated, provided you can get to it. Protection from mechanical damage shall be specially considered. Through-hull fittings and cutoff valves must be of metal, except in non-metallic hulls where materials with the same strength and degree of safety and heat resistancy as afforded by the hull are acceptable. All such non-metallic piping systems must be approved by the OCMI. Non-metallic piping must not be used in fuel systems except where specifically permitted in this part. The piping in vital systems of S vessels, ferry vessels, those carrying more than 49 passengers, and vessels over 65 feet long, must comply with Subchapter F.

Rigid non-metallic materials are acceptable in bilge, ballast, and machinery (except fuel) connections tc piping systems on all other vessels. Rigid non-metallic materials are acceptable for use in non-vital piping systems.

6.11 Part 183: Electrical Installation

Part 183 deals with electrical installation of vessels under 100 gross tons; however, electrical equipment and circuits that are a necessary part of any system vital to the safe navigation of the vessel, such as a vessel using electrical propulsion, or steering systems, will be given special consideration by the OCMI, and the requirements of Sub-chapter J (Electrical Engineering) will normally be used.

The regulations contained under this part are for the most part in accord with the established codes and recognized marine standards and practices. Certain of these are: Electrical Engineering Regulations CG 259, Sub-chapter J; the Recommended Practices for Electrical Installations on Shipboard, the Institute of Electrical and Electronics Engineers, Inc.; The National Electrical Code by the National Fire Protection Association; and Standards issued by the Underwriters Laboratory. The electrical installations for T boats are divided into two sections. One deals with systems of less than 50 volts and the other large section with systems operating 50 volts and more.

6.11a Systems under 50 Volts. All generators, motors, and other major power equipment must have a nameplate that will indicate the manufacturer, its rating in volts and amperes or volts and watts; and, when intended for grounding, the grounding polarity must be indicated. Do not paint over nameplates.

Generators and motors must be placed in a dry, accessible, and ventilated location, and they must not be in low or pocketed positions. They must be mounted as high as practical above the bilges. All generators must be suitably protected from overcurrent by circuit breakers, fuses, or by an overcurrent relay.

Vessels longer than 65 feet, if both required power bilge pumps are electrically driven, must have two generators. One of these generators must be driven by means other than either of the main propulsion engines, if twin engines are installed.

Fig. 6.14

Switch boards. Switch boards must be placed in a dry, accessible, and adequately ventilated location, and if possible, outside the engine compartment. All uninsulated current-carrying parts must be mounted on non-absorbant, non-combustible high dielectric (electricity insulating) materials. Dead-front type switch boards must be used wherever they are accessible to the passengers. All ungrounded conductors of current supplying lights, motors, or appliances must be equipped with a circuit

breaker or switch and fuses at the point of attachment to the power source. Switches, if not mounted on the switchboard, must be of the enclosed type. If the storage battery is not in the same compartment as the main switchboard, it must be fused close to the battery.

Batteries. Batteries must be in well-ventilated areas in order to dissipate the dangerous gases released. Batteries must not be located in the same compartment with a gasoline engine or tank, but if it is impossible to put them elsewhere, they should be suitably protected so that sparks will not be caused by something accidentally dropping across the terminals. Batteries must be located as high above the bilge as practical and secured against shifting. They must have at least 10 inches headroom. Battery terminals must be of the soldered lug type. Temporary battery clamps are not permitted. Acid batteries must be located in a tray of lead or other suitable material resistant to the action of the electrolite. Alkaline batteries using metal containers must be mounted on suitable insulating support and prevented from making contact with other metal that may result in a short circuit. A battery charger, intended for connection to a commercial supply voltage, must employ a transformer of the insulating type, and must include an ammeter that is readily visible. Where a resistor is used to drop the voltage for charging the battery, it must be mounted in a suitably ventilated non-combustible enclosure.

Fig. 6.15

Radio-telephone equipment. Each radio must be fed through a separate circuit from the main distribution panel. The supply cable to the radio-phone installation must be of sufficient size to carry the current under any condition of normal operations. Circuit breakers must be the manually reset type designed for inverse time relay, instantaneous short circuit protection, and they must be capable of repeatedly opening the circuit on which it is used without damage to the circuit breaker.

Accessories. All accessories such as switches, fuses, and sockets must be standard National Electric Code type for the load to be carried. All lights, receptacles, and switches exposed to the weather must be watertight and, on vessels operating in salt water, they must also be corrosion resistant.

Cable size. The size of cable to be used for any particular circuit is primarily a design characteristic but is based upon the amperage that will be conducted by that cable. However, no conductor smaller than No. 14 American Wire Gage must be used except for short fixture leads or intercommunication wiring. Other tables are provided for the designer that take into account the length of cable that is going to be run, the type of insulation needed on the cable, and other tables stating the type of flexible cords that may be used.

Wiring installation. All wiring must run as high as practical above the bilges and, where subject to damage, it must be protected in accordance with the National Electric Code, in metal raceways, conduit, or metallic tubing. Joints and splices must be mechanically secure and made only in junction boxes. Splices in lighting or power wiring must be made with either an insulated pressure wire connector (listed by the Underwriters Laboratory), or thoroughly soldered, then taped first with rubber and next with friction tape, or the soldered joint must be otherwise protected so as to give an insulation equivalent to that on the conductor. Where the ends of stranded conductors are to be clamped on the terminal screws, they must be formed and soldered unless fitted with pressure terminal conductors listed by Underwriters Laboratory. Conductors must be protected from all over-current by suitable circuit breakers, fuses, or other protective devices. Conductors supplying motors or motor-operated appliances must be protected by a separate over-current device that is set to the motor current. This device must be rated or set at not more than 125 percent more than the full-load current rating of the motor. On metal vessels the enclosures and frames of all electrical equipment must be permanently grounded to the metal hull of the vessel by the use of mounting bolts or any other means. On wooden hulls, all non-current carrying enclosures or frames of major electrical equipment must be connected to a common ground, then run to a ground plate on the vessel's hull. For grounded systems, the negative polarity of the supply source should be grounded. For grounded systems, the use of hull return is not recommended except for the engine starting system.

Fig. 6.16

6.11b Systems of More Than 50 Volts. Each major generator and motor must have a nameplate of corrosion-resistant material with the following information: Name of manufacturer, manufacturer's type of frame designation, output in kW or watts or the horsepower rating, kind of rating (continuous, intermittant), rpm at rated load, amps at rated load, voltage, frequency if AC, number of phases if AC, type of winding (for direct current motors). If the vessel is over 65 feet and both of the required fixed power bilge pumps are electrically driven, the vessel must have two generators, one of which is driven by a means other than a main propulsion engine. Generators and motors on systems of more than 50 volts must also be mounted as high as possible above the bilges and cannot be located in low or pocketed positions. If located below deck, generators and motors must be put in as dry a place as practical. Motors for use in locations exposed to the weather must be of a watertight construction or enclosed in a watertight housing. The motor enclosure or housing must be provided with a check-valve for drainage or a tapered hole (which may be secured) at the lowest point of the frame. Generators and motors for use in the machinery spaces will generally be designed for ambient temperatures of 50°C (122°F). Generators and motors for other locations, or for the engine room if it can be substantiated

that temperatures remain below 40°C, may be rated at ambient temperature of 40°C. Generators and motors designed for 40°C ambient operating temperature may be used in locations where 50°C ambient temperatures will be obtained, if they are derated to 80 percent of their full-load rating and the over-current device is reduced accordingly. If this is done, the generator or motor must carry an additional nameplate specifying this fact. A voltmeter and an ammeter must be provided for use on each generator. In an alternating current system, a means for measuring the frequency must be provided, including all additional control equipment and instruments necessary.

Equipment protection and enclosure. All electrical equipment must be drip-proof, meaning that it is so constructed that its successful operation will not be interfered with by falling moisture or dirt, and rotating or uninsulated parts cannot be inadvertantly touched. Equipment mounted on a hinged door must be so constructed that no person will be exposed to live electric components by accidental contact when the door is opened and the current is energized. A sign must be placed in any cabinet, panel, or box containing more than one source of power in excess of 24 volts. Distribution panel boards must be safety type. The main distribution panel--meaning that device to which the generator leads are connected--must be either drip-proof, protected, or fitted with drip hoods and non-conducting handrails and a non-conducting mat or grating on the deck, in front of and at the rear of the panel. Adequate working space must be provided around the main distribution panel, meaning at least 24 inches in the front and 18 inches in the rear, if accessible from the rear. This main distribution panel must be in a dry, accessible, and adequately ventilated location and, if possible, outside the engine room. All uninsulated current-carrying parts must be mounted on non-absorbant, non-combustible high dielectric insulating material. The main distribution panels must be the dead-front type where voltage to ground is in excess of 150V AC, or 250V DC.

Wiring methods and materials. Wiring methods and materials on systems of more than 50V will not be covered. On systems with voltages in this range, you should not attempt to jury rig wiring; get a proper marine electrician to handle this work. However, you should be aware that the enclosures of all equipment must be permanently grounded and that any disconnection of ground wire will subject you to possible serious injury. All marine lighting fixtures that you might re-install should be Underwriters Laboratory "Marine Type" and carry such a label. A separate circuit is required for all radio-telephone installations.

Your vessel was designed with proper disconnect switches and over-current protection. You should never install larger fuses, larger circuit breakers, or the like, without having the

complete system checked by a marine electrician. The purpose of circuit breakers and fuses is to provide protection for the equipment, and over-fusing this protection removes it.

Electrical heating and cooking. Electric spaceheaters for rooms and compartments must have thermal cutoffs to prevent overheating and must be so constructed and installed as to prevent hanging flammable objects on the heaters. All electric cooking equipment, attachments, and devices must be of rugged construction, designed to permit safe cleaning, maintenance, and repair. Many a boat has burned to the waterline because of grease collecting in and around stoves or cooking equipment. All doors on these stoves must have heavy-duty hinges and locking devices, and the entire unit must be well mounted. Electrical ranges must have sea rails with suitable barriers to resist accidental cook-pot movement.

Shore power. A conveniently located watertight shore power connection box or receptacle and the cable connecting this box receptacle to the main distribution panel must be permanently installed. The cable must have a disconnect means located at or near the main distribution panel.

6.12 Part 184: Vessel Control and Miscellaneous Systems and Equipment

6.12a Cooking and Heating. Liquified petroleum gas and gasoline for any purpose such as cooking, heating, or lighting is prohibited on all vessels covered by Part 184.

6.12b Mooring Equipment. Anchors, cables, and hausers must be fitted as required by the OCMI for that size vessel and the water along which it operates.

6.12c Navigational Lights, Shapes, Whistles, Foghorns, and Fogbells. All vessels must be fitted with the navigation equipment prescribed by law and regulation as set forth in the Rules of the Road covering the waters upon which the vessel will be operating. The regulations provide a table that sets the candlepower necessary to achieve the proper distance of visibility for lights. As a further aid another table gives the number of the proper bulb to use for your lights on vessels less than 65 feet in length with six to 32V electrical systems. Another table gives the wattage necessary to achieve the proper visibility on vessels using 110V systems and incandescent lamps in their navigational lights.

6.12d Light Screens. The regulations require light screens (for sidelights) when mentioned in the applicable Rules of the Road to be painted with a glossy black, although the specific Rules of the Road may not require such black paint.

6.12e Compasses. All vessels must be fitted with a suitable compass unless they are certificated for river service only, or they are not self-propelled, or unless they are operating in protected waters with only short restricted routes stated on their Certificate of Inspection.

6.12f Radio. Vessels subject to Part 184 are likewise subject to the applicable Federal Communications Commission regulations concerning their radio installations.

Fig. 6.17

6.12g Emergency Lighting. Sub-chapter T boats must be equipped with a suitable number of portable battery lights. Battle lanterns are the normally required lights.

Additionally, vessels with lounge areas below the main deck must have an emergency lighting system fitted along the line of escape from these lounge areas.

6.12h Engine Room Communication System. If the vessel is not equipped with pilothouse control, an efficient communication system must be provided between the pilothouse and the engine room if deemed necessary by the OCMI.

6.12i Work Vest. Any work vest carried aboard vessels subject to Part 184 must be of Coast Guard approved type, but they are not to be considered part of the normally required lifesaving equipment; they must be stowed separately from the life preservers. These work vests should be examined by the inspector at the time of inspection although they are not stamped. The regulations require the destruction of a work vest, or for that matter a life preserver, that is found to be in a non-repairable condition.

6.13 Part 185: Operations

6.13a Penalties. The penalties for violation of Part 185 will depend upon the gravity of the violation but can go as far as: (a) assessment and collection of civil monetary (money) fine; (b) criminal prosecution when no loss of life results; (c) criminal prosecution for manslaughter where loss of life results from a violation of statute or regulation or for misconduct, negligence, or inattention to duty; (d) liability, meaning suit and/or seizure, against the vessel. In addition, licensed or certified personnel may lose their license or Z Card for any act of misbehavior, negligence, unskillfulness, or incompetency.

6.13b Exhibition of License. The operator must have his license in his possession at all times that he is operating the vessel. The normal procedure is to post the license under glass in the pilothouse.

Fig. 6.18

6.13c Notice of Casualty. The Coast Guard Marine Inspection Office must be notified whenever any casualty results in damage to property in excess of $1,500; major damage affecting the seaworthiness or efficiency of the vessel, its machinery, or equipment; loss of life; or any injury causing a person to remain incapacitated for more than 72 hours.

6.13d Hazardous Materials Incidence. If you are engaged in the transportation of certain hazardous materials you should become aware of additional regulations that set forth notice and reports concerning these materials, which are not within the scope of this chapter.

6.13e Reckless or Negligent Operation. Reckless or negligent operation may lead to the suspension of your license or Z Card and the penalties described above.

6.13f Accident Assistance. It is a provision of law, as well as one of the oldest and strongest traditions of the sea, that every vessel goes to the assistance of every other vessel in need, insofar as is reasonable under the circumstances.

6.13g Compliance with Certificate of Inspection. Every person in charge of a vessel is under the duty to comply with all the provisions of the Certificate of Inspection except as may be necessary to go to the assistance of vessels in distress or under other similar emergency situations.

6.13h Before Getting Underway. The regulations require a test of the steering gear before getting underway, as well as testing the whistle and other controls and communications systems. The operator must also assure himself that all exposed hatches are properly secured.

6.13i Fuel. The regulations prohibit taking aboard gasoline or other fuel having a flash point of 110°F or lower when passengers are aboard.

6.13j Patrolman. If the vessel is equipped with sleeping accomodations in the passenger lounge, a member of the crew must be designated as a roving patrolman and check or inspect these spaces to ensure that safe conditions are being maintained.

6.13k Emergency Check-Off List. An emergency check-off list is required to be posted in a conspicuous place accessible to both passengers and crew, and it must contain not less than the portions of the recommended check-off list that are appliable to that vessel. The recommended check-off list is contained in the regulations.

6.13ℓ Placards for Inflatable Life Rafts. Every vessel equipped with inflatable life rafts must have posted in a conspicuous place approved placards containing instructions

for launching inflatable life rafts. The number and location of these placards is set by the OCMI. These placards must be furnished by the manufacturer of the life rafts.

6.13m Drills. The person in charge of the vessel must conduct such drills and give such instructions and training as are necessary to ensure that all hands are familiar with their duties in normal as well as emergency situations.

6.13n Markings. All vessels must be marked with their names on both the port and starboard sides of the bow and with their name and hailing port on the stern. The hailing port is either the vessel's home port or some community within that customs district. Draft marks are also required on both sides of the bow and stern if the vessel is over 20 gross tons.

6.13o Additional Markings Required. All escape hatches and other emergency exits must be marked on both sides using at least one inch letters: "Emergency Exit, Keep Clear."

Remote fuel shutoff stations must be marked in at least one inch high letters indicating the purpose of the valve and the direction to close.

Watertight doors and hatches must be marked on both sides with letters one inch high or more: "Watertight door--close in emergency" or "watertight hatch--close in emergency," unless deemed unnecessary by the OCMI.

6.14 Part 186: Manning

Sub-chapter T regulations concerning manning are very inexact. Basically, manning on these vessels is subject to the will of the OCMI. He sets the manning, which in his judgement is necessary for the safe operation of the vessel. This manning is then placed on the vessel's Certificate of Inspection and must be followed.

General rules of manning by the current New Orleans OCMI Policy will be discussed later in Sec. 6.20c.

6.14a Licenses. The licenses created to cover vessels that come under Sub-chapter T are: (1) the Ocean Operator, to operate in outside or exposed waters; and (2) the Operator License, for operation in partially protected or protected waters. However, a license as Master, Chief Mate, or Second or Third Mate of ocean and coastwise inspected vessels or a license as Master or Pilot of inspected vessels on waters other than ocean or coastwise will also serve to cover vessels subject to Sub-chapter T, provided those licenses cover that type of vessel and the waters in which the vessel will be operating. A table at the end of Part 186 gives further details as to what the licenses issued under this part cover.

6.15 Part 187: Licensing

Part 187 contains all the regulations for the issuing of the licenses established by Sub-chapter T. All other licensing provisions for all other licenses are contained in Sub-chapter B. The licenses covered by this part are for mechanically propelled vessels of less than 100 gross tons carrying more than six passengers and sailing vessels or non-self-propelled vessels of less than 100 gross tons carrying more than six passengers. The license to carry less than six is the motorboat operator's license that is found in Sub-chapter B.

Licenses issued under Part 187 are: (1) the Ocean Operator, and (2) the Operator other than Ocean and Coastwise, commonly called Inland Operator. These two licenses are issued for a term of five years and the applicant must place his signature and left thumbprint on the licenses as well as swear to the truth of the statements on his application; he is therefore subject to prosecution for perjury if he is found to have lied on that application. He likewise takes an oath before the OCMI that he "will faithfully and honestly according to [his] best skill and judgement, without concealment or reservation, perform all the duties required...by law." He must demonstrate his ability to speak, read, and understand English at least as far as found in the Rules of the Road, Aid to Navigation publications, emergency equipment instructions, and machinery instructions. However, special provisions are allowed for Spanish-speaking persons in Puerto Rico and, under a new program, certain illiterate individuals.

6.15a Original License. Certain requirements are necessary for all licenses. A physical examination must be passed. The applicant must meet certain nationality, age, and experience requirements as well as pass the required examination, which includes a character check and references. Conviction of a Court Martial or any narcotic drug law in a Court of Record disqualifies a person from obtaining a license.

Although a license is good for only five years, it may be renewed up to six years after issuance. The additional one year is a period of grace during which the license is not valid but in which it may be renewed.

6.15b Physical Examination. To be eligible for a license you must pass a general physical by the U.S. Public Health Service doctor or other doctor approved by the OCMI. The provision most frequently rejecting a person for a license deals with eyesight--normal color sense together with uncorrected vision of at least 20/100 in both eyes, correctable to at least 20/20 in one eye and 20/40 in the other.

Epilepsy, insanity, senility, acute veneral disease or neurosyphilis, badly impaired hearing, or other defect that would render the applicant incompetant to perform the ordinary duties of a licensed operator are additional causes for rejection.

6.15c Specific Requirements for Inland Operators. For the Inland Operator License, you must be at least 18 years old and submit satisfactory evidence of at least twelve months experience in the operation of the type of vessel for which you are seeking a license. The examination for Inland Operator of mechanically propelled vessels will consist of questions on: Rules of the Road for the waters upon which you will operate; fire protection and fire extinguishing; lifesaving; the operating of propelling machinery, particularly the safe and proper handling of gasoline and gasoline engines; the operations and navigation of motorboats carrying passengers; first aid; and Rules and Regulations of Sub-chapter T applicable to vessels operating on inland waters; pollution laws and regulations.

6.15d Specific Requirements for Ocean Operators. Generally the Ocean Operator's License is limited to 100 miles offshore between such limits as set by the OCMI. However, the local OCMI may extend these limits to more than 100 miles upon such further examination or requirements as he deems necessary.

You must be 19 years old for the Ocean Operator's License and a citizen of the United States. For a license on mechanically propelled vessels you must have the following minimum service: one year of service as a licensed motorboat operator, or two years of service in the deck department in the operation of ocean or coastwise motorboats or small motor vessels; or one year of service as an able seaman on ocean or coastwise steam or motor vessels together with one year of deck department service in the operation of ocean or coastwise motorboats or small passenger vessels, while holding an AB ticket.

6.15e The Examination. The license examination includes: the use of a nautical chart, together with the meanings of various symbols and abbreviations; laying down of compass courses and distances on the chart; International and Inland Rules of the Road; the use of a magnetic compass, including deviation and variation; rudimentary seamanship; aids to navigation; local winds, weather, and currents; local navigational features and conditions; simple first aid, including artificial respiration; emergency signals; use of and reading of weather bulletins and the aneroid barometer; lifesaving and firefighting equipment, including precautions against fire and explosion; the use of fire extinguishers; and the handling of the vessel after fire is discovered; pollution laws and regulations; and rules and regulations of Sub-chapter T

Fig. 6.19

applicable to ocean and coastwise vessels; the operation of propelling machinery, particularly dealing with gasoline; and such further examination as the OCMI may require.

6.15f Actions Against Licenses. Once you have your license it is still subject to suspension and revocation proceedings for misconduct, negligence, or reckless operation. These proceedings are conducted under Sub-chapter K (Marine Investigations and Suspension and Revocaton Proceedings). Let's hope you never have to study or get involved with Sub-chapter K.

6.16 Sub-Chapter B: Licensing and Certification of Marine Personnel

The remainder of this section will deal with sections of the rules and regulations covering marine operations that are either unique, of special interest, or are significantly different from the detailed explanation as already given covering Sub-chapter T.

6.17 Part 10: Licensing of Officers and Motorboat Operators

The rules and regulations for the issuing of the Inland and Ocean Operator's licenses are contained in Sub-chapter T and have been covered previously. The regulations concerning all other marine licenses are contained in Part 10 of Sub-chapter B. We will cover only those licenses of special interest to the oil and mineral or towing phases of the marine industry.

6.17a Requirements for Original Licenses. For any license as Master you must be at least 21 years old. For any license as Mate, limited to the mineral and oil industry, you must be 19 years old. For all licenses, you must be able to prove that you are a U.S. citizen. You must make written application on Coast Guard Form CG 866. You must likewise pass a physical examination and meet the current standards as to your physical condition. The most important section of this exam is eyesight. It includes limits as to the visual acuity as well as color blindness. For your original or first license, you must also present a certificate from the U.S. Public Health Service that you have passed an examination on first aid.

Fig. 6.20

6.17b Service Experience and References. The application will contain lists of the vessels on which you claim to have gained your qualifying service. This experience must be documented by evidence satisfactory to the OCMI. Certificates of discharge are the most reliable and unquestioned evidence

of such service, however, in the mineral and oil industry, letters from the employer that state the necessary information may be accepted by the OCMI. These letters and the information that must be contained and attested to in them varies and is for the most part set by OCMI policy, and it changes as OCMIs change, casualties occur, or experience dictates. At least 25 percent of the required experience must have been obtained in the three years immediately preceding the application. However, service in the armed forces does not count in determining this three years. Experience and service on foreign vessels is creditable, however, it is subject to an evaluation by the Commandant to determine whether it is the equivalent of service on U.S. vessels.

Sea service, as a member of the armed forces of the United States and on vessels owned by the United States is also creditable, but such service must also be evaluated by Coast Guard Headquarters.

References will be required from a Master and two other licensed officers under which you have served. Your fingerprints will be taken and are used to check whether or not you have a criminal record.

The most common licenses issued under Part 10 to people in the mineral and oil industry are the so-called "Master, Mineral and Oil" and "Mate, Mineral and Oil," both of which may be issued as original licenses--meaning the first license obtained.

6.17c Mate of Mineral and Oil Vessels. The proper name for this license is Mate of Steam and Motor Vessels of Not More than 500 Gross Tons. The regulations setting down the experience requirements for this license are contained in 46 CFR 10.05-28. Paragraph A tells us that this license is limited to a stated distance offshore on the continental shelf of the Atlantic, Gulf, or Pacific Coast of the United States. The most common of licenses that you will find is limited to less than 300 gross tons, with a route of Oceans, Gulf of Mexico, not more than 100 miles offshore. This license is further limited to operations in connection with the offshore and mineral oil industries. To go to 300 gross tons or more the radar endorsement is necessary and to go more than 100 miles offshore a loran certificate and training are necessary. For a license for the route of oceans unlimited, knowledge of celestial navigation is required and must be proved by examination.

The minimum service required for this license is two years of service as a licensed officer in charge of a deck watch on mineral or oil vessels (this presumably means Ocean

Operator) or one year of service as master or first class pilot on inland steam or motor vessels plus six months of service in the deck department of coastwise vessels or mineral and oil industry vessels; or one year of service as a licensed master, or two years of service as a licensed mate of ocean and coastwise uninspected vessels; or three years of service in the deck department of ocean or coastwise steam or motor vessels, including mineral and oil industry vessels.

6.17d Master of Mineral and Oil Vessels. The minimum service required for the license as master is: one year as a licensed mate of mineral and oil vessels; or one year as a licensed master or first class pilot of inland steam or motor vessels plus one year in the deck department of coastwise vessels of mineral and oil industry vessels; or two years service as a licensed master of ocean and coastwise uninspected vessels; or three years service in the deck department of ocean or coastwise vessels of which at least one year shall have been as master or person in charge of vessels of at least 50 gross tons. If the required service as master or person in charge has been on vessels of more than 15 and less than 50 gross tons, this service may be accepted as qualifying experience for master of vessels of not more than 100 gross tons.

6.17e Future Licenses. There are rumors and other scuttlebutt to indicate that the Coast Guard may discontinue the issuance of all oil and mineral licenses in the future. The Master and Mate of Freight and Towing Vessels, of not more than 1,000 gross tons will probably be more commonly used. For the Mate of Freight and Towing Vessels, the present regulations require two years on deck including: one year of service in a watch-standing capacity while holding a license as operator of small passenger vessels valid within the area for which the application is made; or one year of service as unlicensed mate; or eighteen months of service as quartermaster or wheelsman. The minimum service for the license as master of freight and towing vessels is four years on deck, including one year of service as licensed mate; or two years of service as unlicensed master; or two years of service as quartermaster or wheelsman while holding a license as mate or first class pilot; or two years of service as unlicensed mate while holding a license as operator of small passenger vessels valid within the area for which the application is made; or three years of service as unlicensed mate.

6.17f Advancement. Thus it appears that the quickest way to advance to the most unrestricted license would be to first obtain the ocean operator's license, which may be obtained at age 19 under Sub-chapter T after two years of service. Then to obtain the mate/freight and towing vessels, after one year of service on the ocean operator's license, and

the master/freight and towing vessels, after one year of service as a licensed mate of freight and towing vessels.

6.17g The Examination. The contents of the various examinations for the types of licenses you will be getting varies from time to time depending upon local as well as Coast Guard policy. However, the regulations do set certain specific definite things that must be covered, although the method or the degree to which these items are covered varies.

The exam as required by the regulations for both the mineral and oil mate and the mate/freight and towing vessels is very similar and includes: chart navigation, piloting, aids to navigation, definitions, International and Inland Rules of the Road, special signals, seamanship, cargo storage and handling, lifesaving apparatus and firefighting equipment, rules and regulations, and the "catch-all"--such further examination of a non-mathematical character as the OCMI considers necessary.

6.17h Uninspected Vessels. Another license that has some applicability in the industries covered by this text is the license for uninspected vessels. This license is due to a difference between United States Laws and International Treaty. Under an International Treaty, Officer's Competency Certificate Convention, 1936, the officers of all vessels over 200 gross tons must be licensed. However, under U.S. laws, diesel or motor-powered vessels are not inspected until they weigh over 300 gross tons. The inspection laws require licensed officers on all inspected vessels. Therefore vessels between 200 and 300 gross tons, not carrying passengers or freight for hire, do not require a license under United States laws because the vessels are not inspected; however they do require a license under this international treaty. Therefore, a special license was created so that we would be in compliance with the treaty--the License for Uninspected Vessels. It not only covers vessels between 200 and 300 gross tons, not carrying passengers or freight for hire, but will also cover vessels over 200 gross tons engaged in the fishing, kelp, or whaling industries which are exempted from the inspection laws of the United States. This license comes either as Master or Mate of Uninspected Vessels. The procedure for obtaining the license and the general rules for this license are very similar to inspected licenses. However, the examination is rather elementary when compared to an examination for inspected vessels. The specific examination requirements can be found in 46 CFR 10.15-31.

6.17i Motorboat Operator. The motorboat operator license is a special license that was established back in 1940. It covers vessels of less than 15 gross tons, propelled by machinery other than steam, which carry six or fewer passengers for

hire. This would include a lot of the small class vessels that are called luggers in this area. You can obtain this license at age 18 and the examination is very similar to the Inland Operator License, however, this exam will give emphasis to the rules and regulations under the Motorboat Act and to gasoline installations.

6.18 Part 12. Certification of Seaman

Fig. 6.21

Part 12 deals with the issuance of seaman's papers, properly called Merchant Marine Documents and commonly called "Z Cards." Four areas will be covered: the requirements for AB; the requirements for lifeboatman; the requirements for QMED (qualified member of the engine department); the requirements for tankerman; and entry ratings.

To obtain a Z Card it is necessary that you establish age, citizenship and character. A Z Card for entry rating is the first document you will get and no experience is necessary. The entry ratings are: ordinary seaman; wiper; steward's department. You must be 16 to obtain a Z Card and if you are not yet 18, you will need a notarized parental consent prior to your obtaining a Z Card. Age and your U.S. citizenship will be established by a birth certificate or baptismal certificate issued within one year of birth. Character will be established by references and a check of various files for a criminal record. The conviction of any narcotic drug law by a court of record will disqualify you from obtaining a Z Card. A seaman's Z Card is necessary for employment on any merchant vessel of the United States of 100 gross tons or more operating in all waters except the navigable rivers of the United States.

In addition to the birth certificate, parental consent if under 18, and the properly filled-out application, you need three unmounted dull-finish photographs of the passport type (meaning 2 inches x 1 1/2 inches) taken within one year and showing the full face at least 1 inch in height with the head uncovered. Further, you will need either a letter of commitment from an employer, evidence of service in the armed forces of the United States; or, if you are enrolled in an approved nautical science training program, a letter from the educational institution attesting to the fact that you are so enrolled.

6.18a Able Seaman. To qualify for AB papers you must be at least 19 years old, pass the prescribed physical examination, and be able to speak and understand the English language. You will be required to pass an examination demonstrating your ability as an able seaman and as a lifeboatman.

Obtaining an endorsement as an able seaman in any water, unlimited, requires three years of service on deck in vessels of 100 gross tons or more operating on ocean or coastwise routes. The endorsement, AB any water--twelve months, requires twelve months of service of a similar nature. The endorsement, AB tugs and towboats--any water, requires 18 months of service on deck in vessels operating on ocean and coastwise routes or on lakes, bays, and sounds connected directly with the seas. These experience requirements are naturally lessened by the letter of evaluation of any nautical science training program you are enrolled in, which will grant certain experience credit and for your formal training obtained in that program.

6.18b Lifeboatman. The AB ticket includes lifeboatman. However, you may obtain endorsement as a lifeboatman if you are a member of another department or prior to obtaining the AB ticket. The experience necessary to obtaining this endorsement is at least one year of sea service in the deck department or at least two years of sea service in other departments of ocean, coastwise, or other lakes, bays, or sounds vessels; or successful completion of a training course approved by the Commandant, a course which must include at least 30 hours of actual lifeboat training, if you have or can produce evidence of having served a minimum of three months at sea aboard ocean or coastwise vessels. Additionally, the Commandant may allow certification as lifeboatman if you are enrolled in an approved nautical science training program, but he requires at least 30 hours of lifeboat training.

The examination for lifeboatman will include practical demonstrations and knowledge as far as the construction, launching, storage, recovery, and operation of lifeboats together with the required equipment and its use; it will include a practical demonstration of the applicant's ability to carry out orders incident to the rowing or sailing of these lifeboats.

6.18c QMED Ratings. The most common QMED ratings found in the mineral and oil or towing industry will be oiler (diesel). Six months of service at sea in the engine department is required before you are eligible to obtain any QMED rating. The Coast Guard may grant some experience credit for enrollment in a diesel mechanic or other engineering type training program.

The examination will include questions of a practical nature as to the proper operation, maintenance, and use of hand tools, pumps, and other machinery commonly found in the engine room, including valves and piping systems.

6.18d Tankerman. The tankerman's endorsement is necessary to qualify you to perform or be in charge of operations on tank

vessels dealing with the handling, discharging, or loading of liquid, inflamable, or combustible cargo. A license as master or mate includes the rating of tankerman. You must furnish satisfactory documentary evidence to the Coast Guard that you were trained in and are capable of performing the functions of tankerman. You must establish, by oral or written examination conducted in English, that you are familiar with the general arrangement of cargo tanks, suction and discharge valves, cargo pumps and hoses, and that you have been properly trained in the actual operation of the cargo pumps, all other operations connected with the loading and discharging of cargo, and the use of fire extinguishing equipment. The tankerman's ticket is limited to the handling of certain grades and classes of cargo that will be indicated on the document.

6.19 Part 14: Shipment and Discharge of Seaman

The law and regulations require that all seamen employed on board vessels of 100 gross tons must be listed under articles. The articles are basically a contract between the master of the vessel and his crew. On foreign voyages shipment and discharge will be conducted before a Shipping Commissioner, or Collector, or Deputy Collector of Customs. These forms may be obtained from the Coast Guard and are made out in quadruplicate carbon copies. The original and first copy are kept by the master, the second copy retained by the shipping commissioner, and the third copy is sent to Commandant (MVP Coast Guard Headquarters, Washington, D.C. 20591; Attention: Merchant Vessel Personnel Records and Welfare Section). The master must enter on his copies any changes made in the crew during the course of the voyage. If any seamen are paid off or discharged during the course of the voyage, they are required to sign a Mutual Release Form on both the original and the first copy of the articles. This paying-off procedure must be conducted before a shipping commissioner if in an American port, or before an American Consul if in a foreign port.

Upon the completion of the voyage, at the payoff, all crew members will sign both the original and duplicate of the articles and the completed copy together with the copies of every Certificate of Discharge or Record of Entry in a Continuous Discharge Book must be forwarded to the Commandant (MVP, Coast Guard Headquarters).

Fig. 6.22 a,b

6.19a Form CG 735-T. The above describes the procedure for foreign voyages, however, most vessels working in the Gulf of Mexico will use what are called Coastwise Articles contained on Form CG 735-T. Under this set the shipping and discharge of a seaman does not have to be conducted by the shipping commissioner or anyone from customs, but it may be done by the master. Vessels in the domestic mineral and oil service will normally forward the CG 735-T on the last day of each calendar

month. This form lists the names as well as other data required by the form, including the dates and places of engagement and discharge of each seaman employed and discharged or whose services were otherwise terminated during the calendar month. This procedure is normally handled by the office on mineral and oil industry vessels.

6.19b Discharging Seaman. Upon the discharge of any seaman and the payment of his wages the seaman should be issued a Certificate of Discharge, Form CG 718A, which contains the full name and citizenship of the seaman, serial number of merchant mariner's document, name and official number of the vessel together with employer, the nature of the voyage, the class to which the vessel belongs, the date and place of shipment and discharge of such seaman, and the rating that he held. Some seamen have a Continuous Discharge Book, although this is rare in the mineral and oil industry, in which case such information must be entered by the master in the Continuous Discharge Book. This certificate of discharge is very important as it is the best evidence to submit for proof of service when you are attempting to obtain or upgrade your license. Certificates of discharge should always be kept. If you lose them there is a charge for duplicates that may be required when you attempt to get a license.

6.20 Sub-Chapter P: Manning

On an inspected vessel the manning requirements are very simple: check your Certificate of Inspection and man according to the required crew on the certificate. The OCMI who issued the certificate took all the manning laws and regulations into account in setting the requirements for crew as shown on the Certificate of Inspection.

The real problem comes in the area of uninspected vessels. The Officers Competency Certificate Convention, 1936, which is an international treaty, states that all vessels of 200 gross tons and over must have licensed personnel. However, the domestic laws of the United States do not require certain of these vessels to be inspected. Therefore, a special license for uninspected motor vessels between 200 gross tons and 300 gross tons, and certain of the fisheries, is required.

6.20a Three Watches. Section 2 of the Seaman Act of 1915 required all crews to be segregated in the three watch system. This Act is applicable to all vessels of 100 gross tons and over; however, the deck department of tugs and barges, when on voyages of less than 600 miles, is exempted from this provision and may be established on a two watch system. However, personnel of the engineering department are still required, even though the voyage is less than 600 miles, to be on a three watch system. Under this same Act, no licensed officer in the deck

or engineering department must be required to be on duty more than eight hours in any day, except under extraordinary circumstances, or where the exception applies.

6.20b Crew. The Seaman Act of 1915 further states that at least 65 percent of the deck crew, exclusive of licensed officers and apprentices, must be able seamen. Thus, your deck crew must be composed of two ABs for every ordinary seaman in the crew. It further requires that at least 75 percent of the unlicensed crew and 100 percent of the licensed officers be citizens of the United States.

6.20c Lifeboatman. Each lifeboat or liferaft must have the following certified lifeboatmen: one for each inflatable liferaft aboard; if the vessel is equipped with lifeboats and is certified for ocean service, there shall be two lifeboatmen for every lifeboat with a complement of up to forty persons; if the vessel is certified for any service other than ocean, there is required only one lifeboatman for each lifeboat up to 25 capacity and two lifeboatmen for each lifeboat from 26 to 40 capacity. These requirements are found in Sub-chapter I, Cargo Vessels, Table 97.14-10(a). Similar tables are found in tank vessel regulations, Sub-chapter H; although the number varies.

6.20d New Orleans Manning Policy. The current policy of the inspection office in New Orleans is that vessels under 100 gross tons operating on oceans must have two licensed operators and two deckhands, however, the certificate further states that when the vessel is operated less than twelve hours in any 24 hour period, the required crew may be reduced to one licensed operator and one deckhand.

If the vessel is less than 100 gross tons and operating on lakes, bays, and sounds, or other inside waters, the required crew is two licensed operators, and if operating less than twelve hours in any 24 hour period, only one licensed operator. Thus, if the vessel is operating inside, no deckhands are required on vessels subject to Sub-chapter T.

On freight boats, the normal requirement in New Orleans is one licensed master, two licensed mates, two able-bodied seamen, one ordinary seaman, and one other person allowed in the crew. There is an additional clause on the certificates of these boats stating that when the vessel is operating less than sixteen hours in any 24 hour period, the required crew may be reduced to one licensed master, one licensed mate, and two able-bodied seamen.

6.21 Sub-Chapter E: Load Lines

Generally speaking, all vessels of 150 gross tons or over are subject to the provisions concerning load lines. The

American Bureau of Shipping has been designated as the primary assigning and issuing authority for load lines. As such, ABS reviews plans, inspects vessels, issues load line certificates, and verifies compliance.

Load lines are very complicated and a very technical subject. For your information as an operator, it is only necessary that you appreciate the significance of the load line. The load line establishes the depth to which a vessel may be loaded and still be operated legally. The freeboard deck is the deck from which all load line marks are measured as indicated on the load line certificate. This may be a deck wholly enclosed by what is normally thought of as the hull if the uppermost or weatherdeck has what is called a tonnage opening. When this is the case, that part of the hull that is above the freeboard deck is treated as a superstructure as far as the application of the conditions of the assignment of the load line and the calculation of the freeboard is from that lower deck. This space above the freeboard deck, although it may be for all practical purposes completely within the hull, is not considered cargo carrying space--at least as far as determining gross and not tonnage. The load line, or lines are frequently called Plimsoll marks. They consist of three main parts: the deck line, the circle, and the Christmas tree. The deck line is a horizontal line twelve inches in length and one inch in thickness. It must be marked amidship on each side of the vessel and its upper edge will normally pass through the point where the upper edge of the freeboard deck intersects the outer surface of the shell. This deck line is the reference line from which all the other load lines are determined. The load line itself consists of a ring twelve inches in outside diameter and one inch in width that is intersected by a horizontal line eighteen inches in length and one inch in width, the upper edge of which passes through the center of the ring. The center of the ring is placed amidship and at a distance equal to the assigned summer freeboard, measured vertically below the upper edge of the deck line. The Christmas tree is a series of additional load lines that allow adjustments to the summer load line for either the seasonal operation of a vessel, its geographical operation, or its operation in waters other than normal saltwater. Normally additional load lines are located forward of the circle, and they must be at least nine inches in length and one inch in breadth and perpendicular to a vertical line one inch in breadth marked twenty-one inches forward of the center of the ring. The summer load line is marked with an "S" and is a continuation of the load line through the center of the disc. The winter load line is below the summer line, and is marked with a "W." The winter North Atlantic load line, below the winter load line is marked with a "WNA." The tropical load line is above the summer load line and is marked with a "T." The freshwater load line is marked

Fig. 6.23

abaft, meaning aft, of the vertical line and is indicated by an "F." The difference between this freshwater load line and the summer load line is the allowance to be made for loading in freshwater. The tropical freshwater load line, also aft of the vertical line, is indicated by "TF."

You may see vessels with two Christmas trees. The other one located aft of the circle is a special set of load lines allowed for a vessel that is loading lumber on deck and is called the lumber load line. The vessel must always have aboard the Load Line Certificate--the actual document assigning the load line--and should be checked anytime there is a question as to the validity of the load line marked on the side of the vessel. Additionally, you will notice on the line extending through the center of the circle, the letters, A on one side and B on the other. This stands for American Bureau and indicates that the load line was assigned by the American Bureau of Shipping.

You may also run across vessels that have a diamond instead of a circle. This is a special load line for the Great Lakes. Additionally, vessels in special services will have an "SS" printed above their Christmas tree.

The new International Load Line Treaty of 1966 requires all vessels over 79 feet in length to be assigned load lines. However, this treaty is only applicable for vessels on an international voyage. Domestic U.S. Law (under Acts of Congress) requires a load line for over 150 tons. Most vessels, particularly large rig-moving towboats, are having load lines assigned so that they are capable of working overseas as well as in domestic waters.

6.22 Sub-Chapters D and I

Sub-chapter D concerns the rules and regulations for tank vessels and Sub-chapter I concerns the rules and regulations for cargo and miscellaneous vessels. In the oil and mineral industry you will probably come across Sub-chapter I when dealing with supply vessels and possibly, in the future, inspected tugs. Sub-chapter D for tank vessels will probably be used by you only if you go into the towing industry and tow oil or other hazardous cargoes. A detailed explanation of these sub-chapters will not be given. Many of the provisions of both of these sub-chapters parallel Sub-chapter T, which we have already gone over in detail. The major differences between D, I, and T (as already covered) will be found in the areas of lifesaving equipment and fire fighting regulations.

One additional thing, however, must be noted about Sub-chapter D--tank vessels. Behind all section titles in the tank

vessel regulations, you will see letters that tell what vessels this particular section of the regulation concerns. The letter "T" signifies only Tank Ships. The letter "B" signifies service on all waters; "O" stands for ocean waters; "C" for coastline; "L" for Great Lakes; and "R" for river services.

6.22a Radio Regulations. Radio regulations are contained in Title 33 CFR or Title 47 CFR. The provisions dealing with radio installations will be covered elsewhere in this work.

6.22b Customs. Any vessel returning to or preceeding from a port of the United States to a port outside the United States must clear with Customs. This procedure will normally be done by your office, although if you are master, you may have to go down and sign various documents. The procedure for clearing customs to proceed foreign is called clearance. The procedure for returning to the United States is called entrance. Copies of a ship manifest, which is required on foreign voyages, crew lists, and additional documents may be required.

6.22c SOLAS 1960. The International Conference on Safety of Life at Sea (SOLAS), 1960, is an international treaty to which the United States is signatory. It applies only to those ships engaged in international voyages and normally exempts cargo vessels of less than 500 gross tons. However, in many respects the United States government has adopted portions of SOLAS 60 in its domestic regulations, although not specifically required to do so. SOLAS 60, however, does require a radiotelephone installation and therefore a Radiotelephone Safety Certificate for all cargo (supply boats) vessels of 300 gross tons and over.

DEPARTMENT OF TRANSPORTATION

COAST GUARD

RULES AND REGULATIONS
FOR
SMALL PASSENGER VESSELS
(UNDER 100 GROSS TONS)

1 JULY 1977

CG-323

Fig. 6.1 Rules and regulations pertaining to the marine industry are found in publications such as these.

Fig. 6.2 Sub-Chapter T.

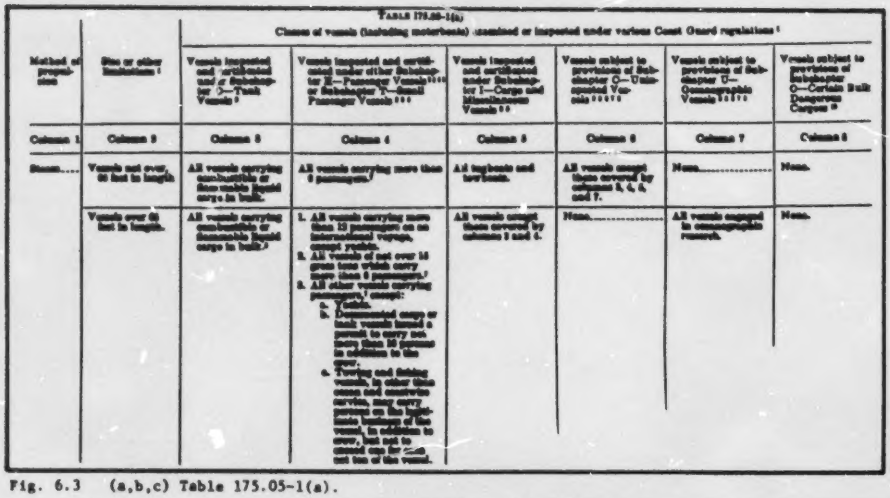


TABLE 175.05-1(a)

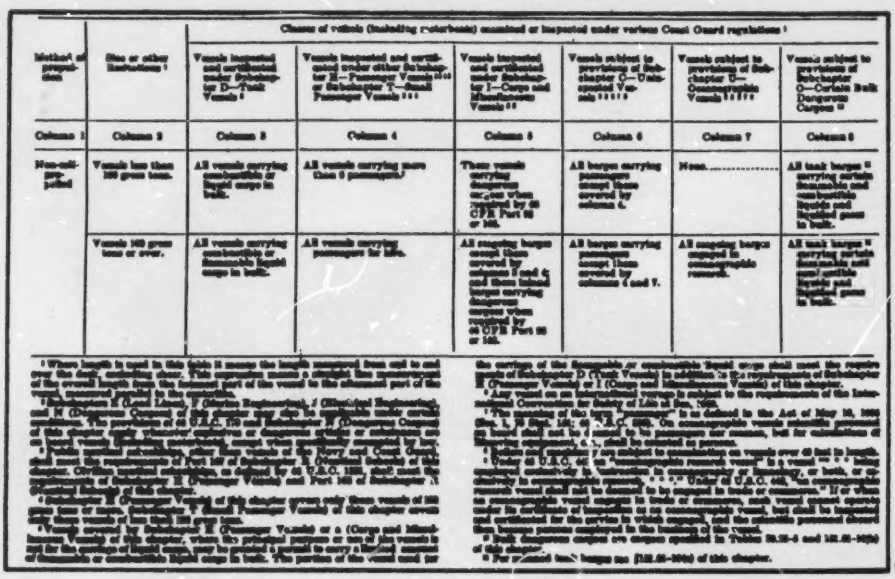
Classes of vessels (including motorboats) examined or inspected under various Coast Guard regulations [1]

Method of propulsion	Size or other limitations [2]	Vessels inspected and certificated under Subchapter D—Tank Vessels [3]	Vessels inspected and certificated under other Subchapter H—Passenger Vessels [4] [5] or Subchapter T—Small Passenger Vessels [6]	Vessels inspected and certificated under Subchapter I—Cargo and Miscellaneous Vessels [7]	Vessels subject to provisions of Subchapter O—Uninspected Vessels [8] [9] [10]	Vessels subject to provisions of Subchapter U—Oceanographic Vessels [11] [12]	Vessels subject to provisions of Subchapter O—Certain Bulk Dangerous Cargoes [13]
Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8
Steam	Vessels not over 65 feet in length.	All vessels carrying combustible or flammable liquid cargo in bulk.	All vessels carrying more than 6 passengers. [14]	All tugboats and towboats.	All vessels except those covered by columns 3, 4, 5, and 7.	None	None.
	Vessels over 65 feet in length.	All vessels carrying combustible or flammable liquid cargo in bulk. [15]	1. All vessels carrying more than 12 passengers on an international voyage, except yachts. 2. All vessels of not over 65 gross tons which carry more than 6 passengers. 3. All other vessels carrying passengers, [16] except: a. Yachts. b. [Deleted] except as to tank vessels issued a permit to carry not more than 12 persons in addition to the crew. c. Tugboat and towboat vessels, in other than ocean and coastwise service, that carry passengers not for hire, in addition to crew, but not to exceed one for each 100 net tons of the vessel.	All vessels except those covered by columns 3 and 4.	None	All vessels engaged in oceanographic research.	None.
Motor	Vessels not over 15 gross tons.	All vessels carrying combustible or flammable liquid cargo in bulk.	All vessels carrying more than 6 passengers. [14]	Those vessels carrying dangerous cargoes when required by 46 CFR Part 98 or 146.	All vessels except those covered by columns 3, 4, 5, and 7.	None	None.
	Vessels over 15 gross tons except sailing vessels of 500 gross tons and over.	All vessels carrying combustible or flammable liquid cargo in bulk. [15]	1. All vessels carrying more than 12 passengers on an international voyage, except yachts. 2. All vessels not over 65 feet in length which carry more than 6 passengers. [16] 3. All other vessels of over 65 feet in length carrying passengers [16] (or vessels carrying cargo or mail vessels issued a permit to carry not more than 12 persons in addition to the crew).	All vessels carrying freight for hire except those covered by columns 3 and 4.	All vessels except those covered by columns 3, 4, 5, and 7.	None	None.
	Sailing vessels of 500 gross tons and over.	All vessels carrying combustible or flammable liquid cargo in bulk. [15]	1. All vessels carrying more than 12 passengers on an international voyage, except yachts. 2. All other vessels carrying passengers, [16] except: a. Yachts. b. [Deleted] (cargo or mail vessels issued a permit to carry not more than 12 persons in addition to the crew).	All vessels except those covered by columns 3 and 4, and those engaged in the fishery, cruising, training, etc., or any other vessels of the fishery, fish, or oyster industry.	All vessels except those covered by columns 3, 4, 5, and 7.	All vessels engaged in oceanographic research.	None.
Sail	Vessels not over 100 gross tons.	All vessels carrying combustible or flammable liquid cargo in bulk.	All vessels carrying more than 6 passengers. [14]	Those vessels carrying dangerous cargoes when required by 46 CFR Part 98 or 146.	None	None	None.
	Vessels over 100 gross tons.	All vessels carrying combustible or flammable liquid cargo in bulk.	All vessels carrying passengers for hire.	Those vessels carrying dangerous cargoes when required by 46 CFR Part 98 or 146.	None	None	None.

See footnotes at end of table.

(a)

(b)



Classes of vessels (including motorboats) examined or inspected under various Coast Guard regulations [1]

Method of propulsion	Size or other limitations [2]	Vessels inspected and certificated under Subchapter D—Tank Vessels [3]	Vessels inspected and certificated under other Subchapter H—Passenger Vessels [4] [5] or Subchapter T—Small Passenger Vessels [6]	Vessels inspected and certificated under Subchapter I—Cargo and Miscellaneous Vessels [7]	Vessels subject to provisions of Subchapter O—Uninspected Vessels [8] [9] [10]	Vessels subject to provisions of Subchapter U—Oceanographic Vessels [11] [12]	Vessels subject to provisions of Subchapter O—Certain Bulk Dangerous Cargoes [13]
Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8
Non-self-propelled	Vessels less than 100 gross tons.	All vessels carrying combustible or flammable liquid cargo in bulk.	All vessels carrying more than 6 passengers. [14]	Those vessels carrying dangerous cargoes when required by 46 CFR Part 98 or 146.	All barges carrying passengers except those covered by column 5.	None	All tank barges carrying certain flammable and combustible liquids and liquefied gases in bulk.
	Vessels 100 gross tons or over.	All vessels carrying combustible or flammable liquid cargo in bulk.	All vessels carrying passengers for hire.	All sailing barges except those covered by columns 3 and 4, and those inland barges carrying dangerous cargoes when required by 46 CFR Part 98 or 146.	All barges carrying passengers, except those covered by columns 3 and 7.	All sailing barges engaged in oceanographic research.	All tank barges carrying certain flammable and combustible liquids and liquefied gases in bulk.

[1] Where length is used in this table it means the length measured from end to end over the deck, excluding sheer. This measurement extends from the foremost part of the vessel, commonly the stem, to the aftermost part of the vessel, commonly the stern.

[2] Subchapters F (Yachts), J (Electrical Engineering), and M (Tank Vessels) of 46 CFR Chapter I apply also to vessels under certain conditions. The provisions of 46 CFR 151.45 apply to vessels inspected or certificated under Subchapter D (Tank Vessels) or Subchapter I (Cargo and Miscellaneous Vessels) of 46 CFR Chapter I, and to vessels inspected under Subchapter H (Passenger Vessels) of 46 CFR Chapter I, which are fitted out for the carriage of liquid cargo in bulk, and to vessels inspected under Subchapter O (Certain Bulk Dangerous Cargoes) of 46 CFR Chapter I. Vessels inspected under Subchapter H (Passenger Vessels) of 46 CFR Chapter I which are fitted out for the carriage of liquid cargo in bulk, or which are certificated for the carriage of oil in accordance with 33 U.S.C. 1001, shall meet the applicable requirements of Subchapter D (Tank Vessels) or Part 151 of Subchapter O (Certain Bulk Dangerous Cargoes) of 46 CFR Chapter I.

[3] Subchapter D (Tank Vessels) of this chapter applies only those vessels of 100 gross tons or more, in commercial service, which are specifically fitted for the carriage of liquid cargo in bulk.

[4] Vessels covered by Subchapter H (Passenger Vessels) or I (Cargo and Miscellaneous Vessels) of this chapter, which are propelled by machinery and which have been issued a Certificate of Inspection endorsed for the carriage of liquid cargo in bulk, the portion of the vessel used or intended for the carriage of combustible or flammable liquid cargo in bulk in bulk shall meet the applicable requirements of Subchapter D (Tank Vessels) in addition to the requirements of Subchapter H (Passenger Vessels) or I (Cargo and Miscellaneous Vessels) of this chapter.

[5] Any vessel on an international voyage is subject to the requirements of the International Convention for Safety of Life at Sea, 1960.

[6] The purpose of this Subchapter is to implement 52 Stat. 1008; 46 U.S.C. 1395. On vessels to which this Subchapter applies, the provisions of Parts 160, 161, and 162 of Subchapter Q (Equipment, Construction, and Materials: Specifications and Approval) of this chapter shall be enforced as follows:

[7] Under 33 U.S.C. 391a, as amended by 64 Stat. 1120, 46 U.S.C. 526p, all vessels subject to inspection under the provisions of Subchapter I (Cargo and Miscellaneous Vessels) of this chapter, which are propelled by machinery and are of 300 gross tons or more, while engaged in the transportation of oil or other dangerous cargoes, as defined by 33 U.S.C. 391a, or mixtures containing oil, shipped in bulk, or in vessels which have been certificated to carry oil in accordance with 33 U.S.C. 1001, shall be inspected at least twice a year at approximately six month intervals. If any vessel is found to be in unsatisfactory condition or not in compliance with the applicable requirements of Subchapter I (Cargo and Miscellaneous Vessels) of this chapter, such vessel cannot operate until the deficiencies noted have been corrected to the satisfaction of the Officer in Charge, Marine Inspection, or other authorized representative of the Commandant, and the vessel has been duly inspected and certificated for the service in which engaged. Such vessels possessing valid Certificates of Inspection when found in compliance with the applicable requirements of Subchapter I (Cargo and Miscellaneous Vessels) of this chapter, shall be inspected annually.

[8] Vessels inspected under the provisions of Subchapter C (Uninspected Vessels) of this chapter.

[9] Vessels propelled by machinery and of 300 gross tons or more, while engaged in the transportation of oil or other dangerous cargoes, as defined by 33 U.S.C. 391a, or mixtures containing oil, shipped in bulk, or in vessels which have been certificated to carry oil in accordance with 33 U.S.C. 1001, shall be inspected at least twice a year at approximately six month intervals. If any vessel is found to be in unsatisfactory condition or not in compliance with the applicable requirements of Subchapter C (Uninspected Vessels) of this chapter, such vessel cannot operate until the deficiencies noted have been corrected to the satisfaction of the Officer in Charge, Marine Inspection, or other authorized representative of the Commandant, and the vessel has been duly inspected and certificated for the service in which engaged. Such vessels possessing valid Certificates of Inspection when found in compliance with the applicable requirements of Subchapter C (Uninspected Vessels) of this chapter, shall be inspected annually.

[10] Vessels inspected under the provisions of Subchapter C (Uninspected Vessels) of this chapter which are fitted out for the carriage of liquid cargo in bulk shall meet the applicable requirements of Subchapter D (Tank Vessels) in addition to the requirements of Subchapter C (Uninspected Vessels) of this chapter.

[11] Any vessel on an international voyage is subject to the requirements of the International Convention for Safety of Life at Sea, 1960.

[12] The purpose of this Subchapter is to implement 52 Stat. 1008; 46 U.S.C. 1395. On vessels to which this Subchapter applies, the provisions of Parts 160, 161, and 162 of Subchapter Q (Equipment, Construction, and Materials: Specifications and Approval) of this chapter shall be enforced as follows:

[13] Under 33 U.S.C. 391a, as amended by 64 Stat. 1120, 46 U.S.C. 526p, all vessels subject to inspection under the provisions of Subchapter O (Certain Bulk Dangerous Cargoes) of this chapter, which are propelled by machinery and are of 300 gross tons or more, while engaged in the transportation of oil or other dangerous cargoes, as defined by 33 U.S.C. 391a, or mixtures containing oil, shipped in bulk, or in vessels which have been certificated to carry oil in accordance with 33 U.S.C. 1001, shall be inspected at least twice a year at approximately six month intervals. If any vessel is found to be in unsatisfactory condition or not in compliance with the applicable requirements of Subchapter O (Certain Bulk Dangerous Cargoes) of this chapter, such vessel cannot operate until the deficiencies noted have been corrected to the satisfaction of the Officer in Charge, Marine Inspection, or other authorized representative of the Commandant, and the vessel has been duly inspected and certificated for the service in which engaged. Such vessels possessing valid Certificates of Inspection when found in compliance with the applicable requirements of Subchapter O (Certain Bulk Dangerous Cargoes) of this chapter, shall be inspected annually.

[14] Only those vessels of 100 gross tons or more, in commercial service, which are specifically fitted for the carriage of liquid cargo in bulk.

[15] Vessels covered by Subchapter I (Cargo and Miscellaneous Vessels) of this chapter, which are propelled by machinery and which have been issued a Certificate of Inspection endorsed for the carriage of liquid cargo in bulk, the portion of the vessel used or intended for the carriage of combustible or flammable liquid cargo in bulk shall meet the applicable requirements of Subchapter D (Tank Vessels) in addition to the requirements of Subchapter I (Cargo and Miscellaneous Vessels) of this chapter.

[16] Any vessel on an international voyage is subject to the requirements of the International Convention for Safety of Life at Sea, 1960.

[17] The purpose of this Subchapter is to implement 52 Stat. 1008; 46 U.S.C. 1395. On vessels to which this Subchapter applies, the provisions of Parts 160, 161, and 162 of Subchapter Q (Equipment, Construction, and Materials: Specifications and Approval) of this chapter shall be enforced as follows:

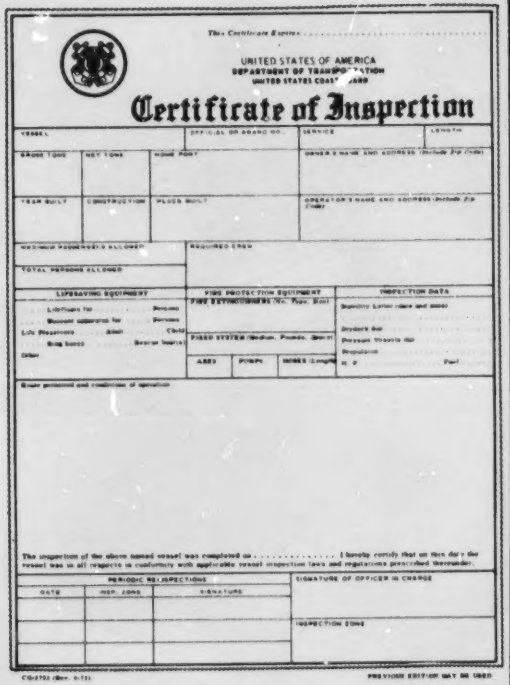
[18] Under 33 U.S.C. 391a, as amended by 64 Stat. 1120, 46 U.S.C. 526p, all vessels subject to inspection under the provisions of Subchapter O (Certain Bulk Dangerous Cargoes) of this chapter, which are propelled by machinery and are of 300 gross tons or more, while engaged in the transportation of oil or other dangerous cargoes, as defined by 33 U.S.C. 391a, or mixtures containing oil, shipped in bulk, or in vessels which have been certificated to carry oil in accordance with 33 U.S.C. 1001, shall be inspected at least twice a year at approximately six month intervals. If any vessel is found to be in unsatisfactory condition or not in compliance with the applicable requirements of Subchapter O (Certain Bulk Dangerous Cargoes) of this chapter, such vessel cannot operate until the deficiencies noted have been corrected to the satisfaction of the Officer in Charge, Marine Inspection, or other authorized representative of the Commandant, and the vessel has been duly inspected and certificated for the service in which engaged. Such vessels possessing valid Certificates of Inspection when found in compliance with the applicable requirements of Subchapter O (Certain Bulk Dangerous Cargoes) of this chapter, shall be inspected annually.

[19] Only those vessels of 100 gross tons or more, in commercial service, which are specifically fitted for the carriage of liquid cargo in bulk.

[20] The [illegible] barges see [illegible] of this chapter.

(c)

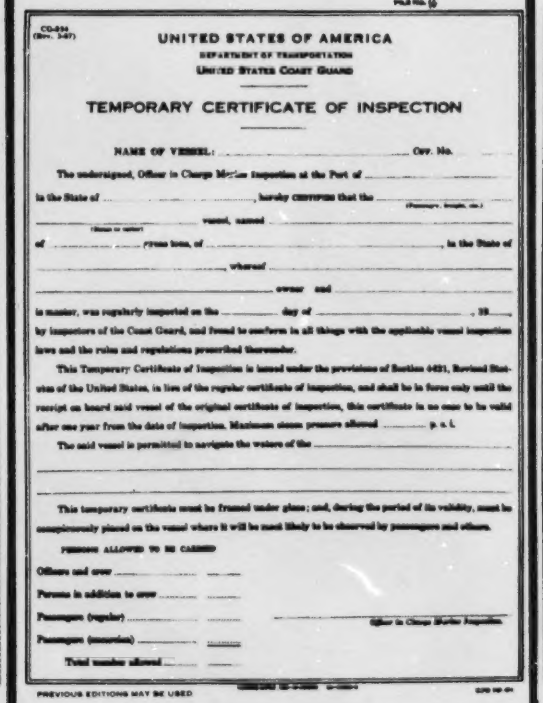
Fig. 6.3 (a,b,c) Table 175.05-1(a).



UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

Certificate of Inspection

Fig. 6.4 Certificate of Inspection.



CG-854
(Rev. 3-67)

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

TEMPORARY CERTIFICATE OF INSPECTION

NAME OF VESSEL: ..... Cert. No. .....

The undersigned, Officer in Charge Marine Inspection at the Port of .....

in the State of ....., hereby CERTIFIES that the ..... (Passenger, freight, etc.)

..... vessel, named .....

(Steam or motor)

of ....., gross tons, of ....., in the State of .....

....., whereof ..... owner and .....

..... master, was regularly inspected on the ..... day of ....., 19....., by inspectors of the Coast Guard, and found to conform in all things with the applicable vessel inspection laws and the rules and regulations prescribed thereunder.

This Temporary Certificate of Inspection is issued under the provisions of Section 4431, Revised Statutes of the United States, in lieu of the regular certificate of inspection, and shall be in force only until the receipt on board said vessel of the original certificate of inspection, this certificate in no case to be valid after one year from the date of inspection. Maximum steam pressure allowed ..... p. s. i.

The said vessel is permitted to navigate the waters of the .....

.....

.....

This temporary certificate must be framed under glass; and, during the period of its validity, must be conspicuously placed on the vessel where it will be most likely to be observed by passengers and others.

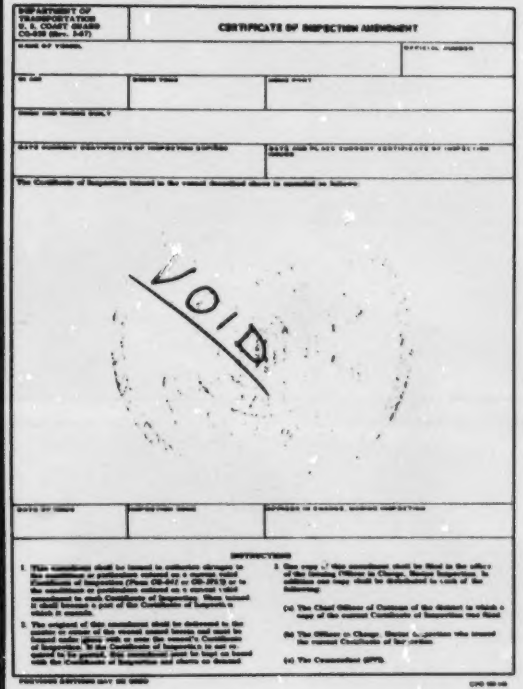
PERSONS ALLOWED TO BE CARRIED

Officers and crew	.....	.....
Persons in addition to crew	.....	.....
Passengers (regular)	.....	.....
Passengers (excursion)	.....	.....
Total number allowed	.....	.....

Officer in Charge Marine Inspection

PREVIOUS EDITIONS MAY BE USED

Fig. 6.5 Temporary Certificate of Inspection.



DEPARTMENT OF TRANSPORTATION
U. S. COAST GUARD
CG-858 (Rev. 3-67)

CERTIFICATE OF INSPECTION AMENDMENT

VOID

INSTRUCTIONS

1. This amendment shall be issued to authorize changes in the conditions or particulars entered on a current valid Certificate of Inspection (Form CG-841 or CG-3913) or to the cancellation or postponement entered on a current valid endorsement to such Certificate of Inspection. When issued it shall become a part of the Certificate of Inspection to which it extends.

2. The original of this amendment shall be delivered to the master or owner of the vessel named herein and must be found under agent with or over the vessel's Certificate of Inspection. If the Certificate of Inspection is not required to be posted, this amendment must be kept on board with the Certificate of Inspection and shown on demand.

3. One copy of this amendment shall be filed in the office of the Issuing Officer in Charge, Marine Inspection. In addition one copy shall be distributed to each of the following:

(a) The Chief Officer or Chairman of the district in which a copy of the current Certificate of Inspection was filed.

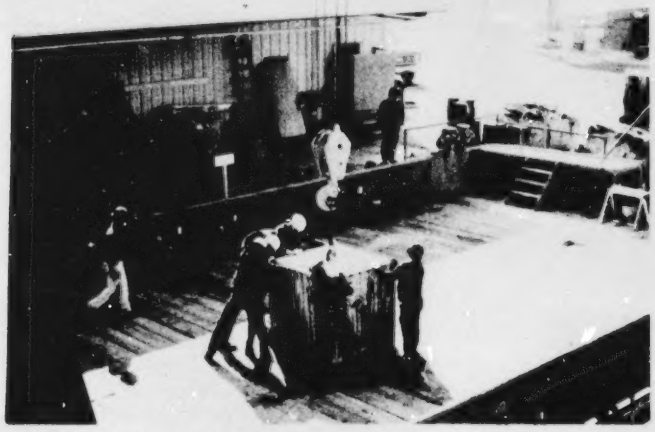
(b) The Officer in Charge, Marine Inspection who issued the current Certificate of Inspection.

(c) The Commandant (EPS).

PREVIOUS EDITIONS MAY BE USED

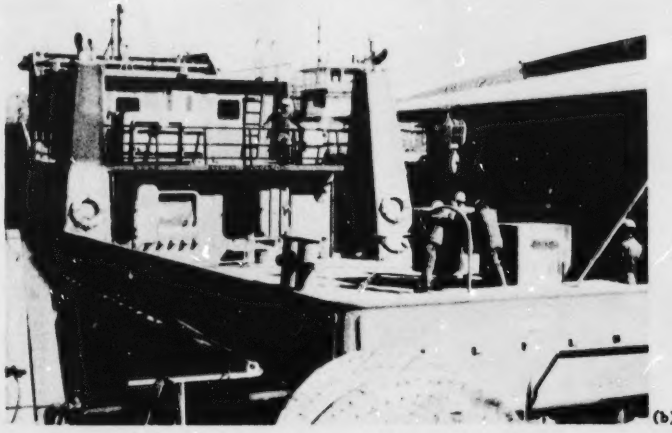
Fig. 6.6 Certificate of Inspection Amendment.

Fig. 6.7 The regulations require that certain vessels be drydocked periodically.

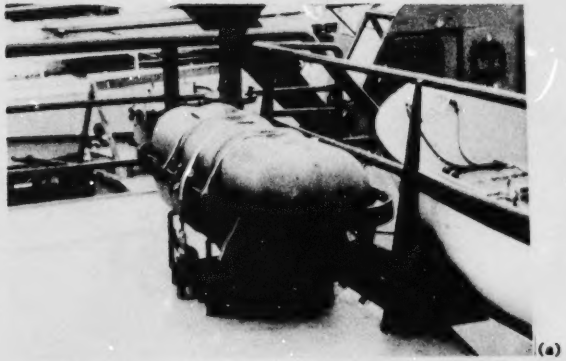


(a)

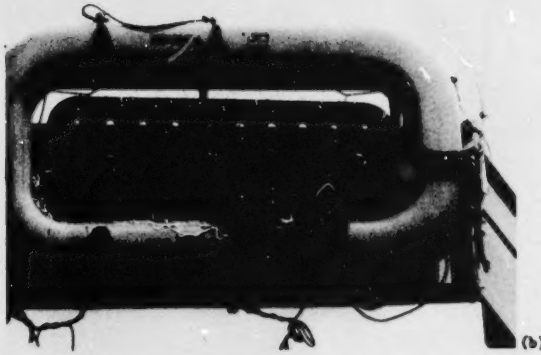
Fig. 6.8 (a,b) Stability test.



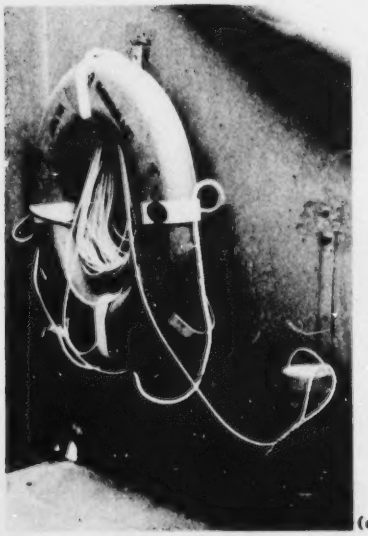
(b)



(a)



(b)



(c)

(d)

(e)

Fig. 6.9 Lifesaving equipment: (a) Inflatable life raft; (b) rigid life raft (buoyant apparatus); (c) ring buoy with waterlight attached; (d) life preservers in the stowed position; (e) pyrotechnic distress signals.

Fig. 6.10 Fire station.

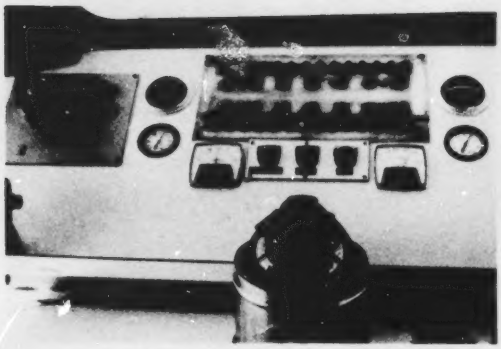


Fig. 6.11 Steering console and gages.

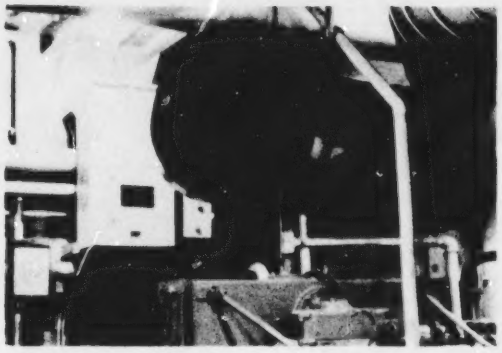


Fig. 6.13 Engineroom blower.

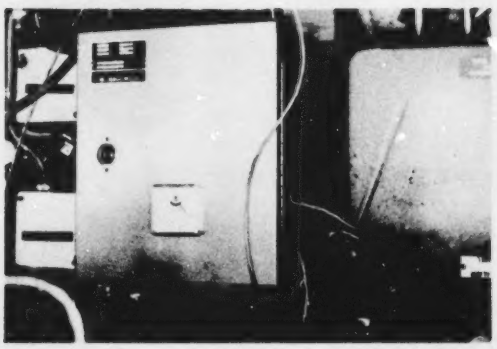


Fig. 6.15 Constavolt battery charger.

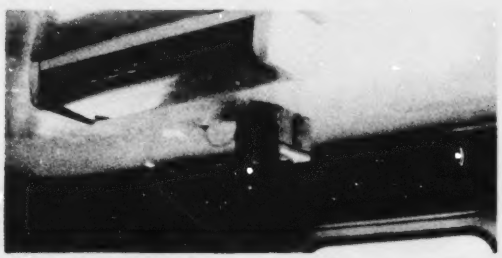


Fig. 6.17 Emergency light.

Fig. 6.12 Gooseneck vents for the forepeak.

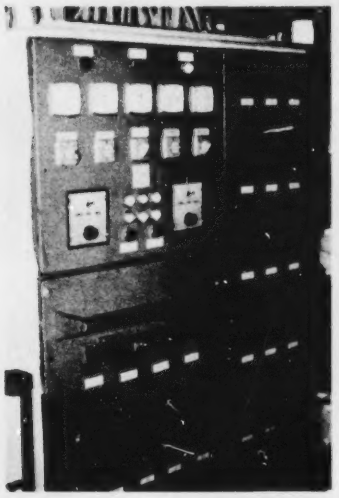


Fig. 6.14 Electrical switchboard.

Fig. 6.16 Marine vaporproof light.

DEPARTMENT OF TRANSPORTATION
U. S. COAST GUARD
CG-2692 (Rev. 12-70)

REPORT OF VESSEL CASUALTY OR ACCIDENT

Form Approved
OMB No. 04-R2003
REPORTS CONTROL SYMBOL
MVI-4017

INSTRUCTIONS

1. An original and two copies of this form shall be submitted, without delay, to the Officer in Charge, Marine Inspection, in whose district the casualty occurred, or in whose district the vessel first arrived after such casualty.
2. If the person making the report is a licensed officer on a vessel required to be manned by such officer, he must make the report in writing and in person to the proper Marine Inspector. If because of distance it may be inconvenient for such an officer to submit the report in person, he may submit the required number of copies by mail. However, to avoid delay in investigations, it is desired that reports be submitted in person.
3. This form should be completed in full; blanks which do not apply to a particular case should be indicated as "NA". Where answers are unknown or none, they should be indicated as such. All copies should be signed.

NOTE: (1) Report all deaths and injuries, which incapacitate in excess of 72 hours, on CG-924E whether or not there was a vessel casualty.
(2) Attach separate Form CG-924E to this report for each person killed or injured and incapacitated in excess of 72 hours as a result of the vessel casualty reported herein.

TO: Officer in Charge, Marine Inspection, Port of — DATE SUBMITTED

I PARTICULARS OF VESSEL

1 NAME OF VESSEL	2 OFFICIAL NUMBER	3 HOME PORT	4 NATIONALITY
5 TYPE OF VESSEL (Ft., passs., tkr., etc.)	6 PROPULSION (Steam, diesel, etc.)	7 GROSS TONNAGE	8 REGISTERED LENGTH OR L O A
9 HULL MATERIALS	10 YEAR BUILT	11 RADIO EQUIPMENT ☐ TRANSMIT ☐ RECEIVE ☐ VOICE ☐ CW (Key)	
12 (a) RADAR EQUIPPED ☐ YES ☐ NO		(b) IF YES, RADAR OPERATING AT TIME OF CASUALTY ☐ YES ☐ NO	
13 (a) CERTIFICATE OF INSPECTION ISSUED AT PORT OF		(b) DATE CERTIFICATE OF INSPECTION ISSUED	
14 (a) NAME OF MASTER OR PERSON IN CHARGE (Indicate which)		(b) DATE OF BIRTH	(c) LICENSED BY COAST GUARD ☐ YES ☐ NO
15 (a) NAME OF PILOT (If on board at time of accident)		(b) PILOT SERVING UNDER AUTHORITY OF LICENSE ISSUED BY ☐ USCG ☐ STATE ☐ FOREIGN	
17 (a) NAME OF OWNER(S) OPERATOR(S) OR AGENT (Indicate which)		(b) ADDRESS OF OWNER(S) OPERATOR(S) OR AGENT	

II PARTICULARS OF CASUALTY

18 (a) DATE OF CASUALTY	(b) TIME OF CASUALTY (Local or zone)	(c) ZONE DESCRIPTION	(d) TIME OF DAY ☐ DAY ☐ NIGHT ☐ TWILIGHT
19 LOCATION OF CASUALTY (Latitude and longitude, distances and TRUE bearing from charted object, clock, anchorage, etc.)			
20 BODY OF WATER (Geographical name)	20 RULES OF THE ROAD APPLICABLE ☐ INLAND ☐ GREAT LAKES ☐ WESTERN RIVERS ☐ INTERNATIONAL ☐ OTHER (Specify)		
21 (a) DID CASUALTY OCCUR WHILE UNDERWAY: ☐ YES ☐ NO			
(b) IF YES, LAST PORT OF DEPARTURE		(c) IF YES, WHERE BOUND WHEN CASUALTY OCCURRED	
22 (a) WEATHER CONDITIONS WHEN CASUALTY OCCURRED: ☐ CLEAR ☐ PARTLY CLOUDY ☐ OVERCAST ☐ FOG ☐ RAIN ☐ SNOW ☐ OTHER (Specify)			
(b) VISIBILITY (Miles, yds., ft., etc.)	(c) WIND DIRECTION	(d) FORCE IN KNOTS	(e) GUSTY ☐ YES ☐ NO — (f) AIR TEMPERATURE
23 (a) SEA CONDITIONS WHEN CASUALTY OCCURRED	(b) SEA WATER TEMP (If available)	(c) HEIGHT OF SEA	(d) DIRECTION OF SEA — (e) HEIGHT OF SWELL — (f) DIRECTION OF SWELL
24 (a) NATURE OF CARGO (Specify)	(b) AMOUNT OF DRY CARGO (Long tons)	(c) AMOUNT OF BULK LIQUID (Long tons)	(d) AMOUNT OF DEAD LOAD (Long tons)
25 (a) DRAFT FORWARD		(b) DRAFT AFT	
26 (a) TYPES OF LIFESAVING EQUIPMENT USED, IF ANY		(b) NO. LIVES SAVED WITH LIFE-SAVING EQUIPMENT	(c) LIFESAVING EQUIPMENT SATISFACTORY ☐ YES ☐ NO (If no, explain in Item 34)

PREVIOUS EDITION MAY BE USED (Over)

Fig. 6.18 Report of Vessel Casualty or Accident.

Fig. 6.19 The Coast Guard examination.

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

Certificate of Discharge to Merchant Seaman

Serial No. I 10253132

(Signature of Seaman)

(Master of Vessel)

I HEREBY CERTIFY that the above entries were made by me and are correct and that the signatures hereto were witnessed by me.

Dated this _____ day of _____, 19____

United States Shipping Commissioner (or Master of Vessel)

Note—Whenever a master performs the duties of the shipping commissioner under this act, the master shall sign the certification on the line designated for the shipping commissioner's signature.

Name of Seaman _____ (In full)

Citizenship _____ U. S. Merchant Mariners Document No. I _____

Rating _____ (Capacity in which employed)

Date of Shipment _____

Place of Shipment _____

Date of Discharge _____

Place of Discharge _____

Name of Ship _____

Name of Employer _____

Official No. _____ Class of Vessel (Steam, Motor, Sail or Barge) _____

Nature of Voyage _____ (Foreign, Intercoastal or Coastwise)

Fig. 6.20 Certificate of Discharge to Merchant Seaman.

Fig. 6.21 Merchant Mariner's Document.

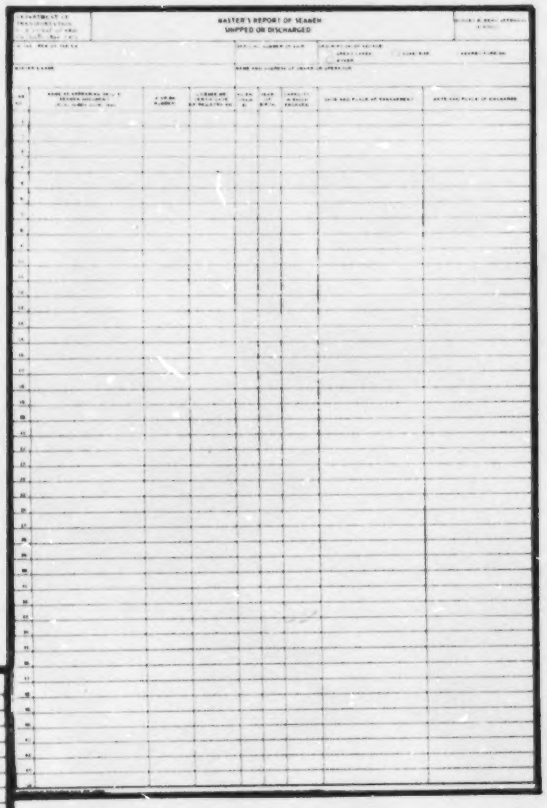
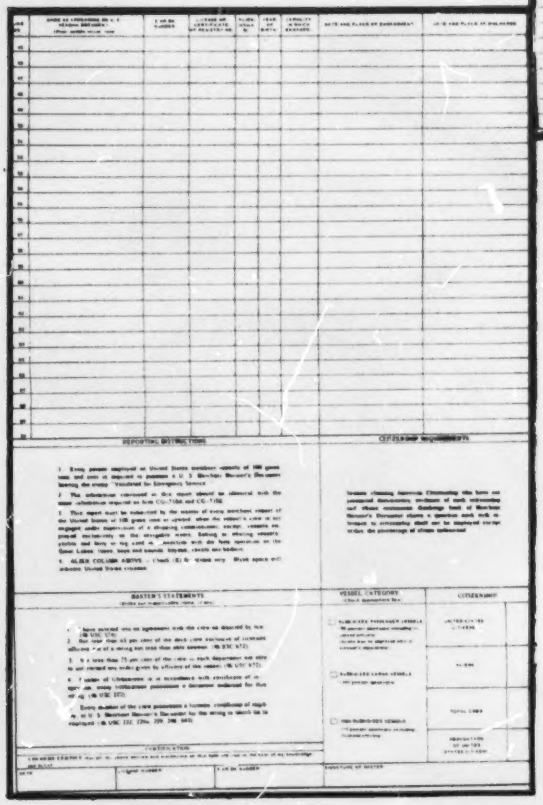
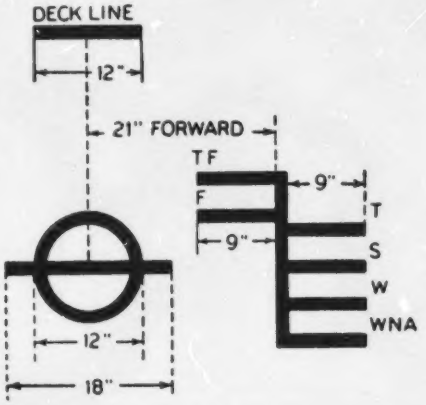


Fig. 6.22 (a,b) Form CG-735-T. (a)



(b)



TF—Tropical Fresh Water Load Line
F—Fresh Water Load Line
T—Tropical Load Line
S—Summer Load Line
W—Winter Load Line
WNA—Winter North Atlantic Load Line

Fig. 6.23 ABS load line marks.

APPENDIX A

Documents

DEPARTMENT OF TRANSPORTATION
U. S. COAST GUARD
CG-924E (Rev. 9-68)

REPORT OF PERSONAL INJURY OR LOSS OF LIFE

Form Approved Budget Bureau No. 004R-3004

REPORTS CONTROL SYMBOL MVI-4014

INSTRUCTIONS

1. This form shall be completed for every loss of life and for every injury which incapacitates the injured for a period in excess of seventy-two hours *(3 days)*, if the accident involves any vessel except those numbered under the Federal Boating Act.
2. Injuries to longshoremen or harbor workers are not required to be reported unless the injury arises out of failure of ship's equipment, a vessel casualty, misconduct or negligence of ship's personnel or the injury results in death.
3. A signed original and two signed copies shall be submitted as soon as possible to the Officer in Charge, Marine Inspection, U. S. Coast Guard, in whose district the accident occurred, or in whose district the vessel first arrive(s)(d) after such casualty.
4. The master or person in charge is required to report in person to the Officer in Charge, Marine Inspection as soon as possible after the casualty occurs unless it can be shown that it was inconvenient to do so because of the distance involved. However, nothing shall relieve the person in charge of the vessel from submitting this report.
5. This report should be completed in full. Blocks which do not apply to a particular case should be indicated as "NA." Where answers are unknown or none, they should be indicated as such.
6. Report all vessel casualties or accidents on Form CG-2692, Report of Vessel Casualty or Accident. Attach a Form CG-924E to the CG-2692 for each person killed, missing or injured as a result of the marine casualty or accident.

TO: Officer in Charge, Marine Inspection, Port of

DATE SUBMITTED

I. PARTICULARS OF VESSEL

1. NAME OF VESSEL	2. OFFICIAL NUMBER	3. VESSEL INSPECTED BY USCG ☐ YES ☐ NO	4. NATIONALITY
5. TYPE OF VESSEL *(Pri., pass., tkr., etc.)*	6. PROPULSION *(Steam, diesel, etc.)*	7. NAME OF OWNER(S), OPERATOR(S), OR AGENT *(Indicate which)*	
8(a) NAME OF MASTER OR PERSON IN CHARGE *(Indicate which)*		(b) LICENSED BY COAST GUARD ☐ YES ☐ NO	

II. PARTICULARS OF PERSON INJURED DECEASED OR MISSING *(Believed dead)*

9(a) NAME OF PERSON	(b) HOME ADDRESS	(c) DATE OF BIRTH
10. BOOK OR "Z" NUMBER	11. LICENSED BY COAST GUARD ☐ YES ☐ NO	12. STATUS OR CAPACITY ON VESSEL
13. ACTIVITY ENGAGED IN AT TIME OF CASUALTY	14. IF CREW MEMBER OR SHORE WORKER ☐ ON WATCH ☐ WORKING ☐ OTHER	
15(a) NAME OF IMMEDIATE SUPERVISOR AT TIME OF CASUALTY	(b) SUPERVISOR'S CAPACITY OR STATUS ON VESSEL	

III. PARTICULARS OF ACCIDENT OR CASUALTY

16. DATE OF CASUALTY	17. TIME OF CASUALTY *(Local or zone)*	18. ZONE DESCRIPTION	19. TIME OF DAY ☐ DAY ☐ NIGHT ☐ TWILIGHT
20(a) DID CASUALTY OCCUR WHILE UNDERWAY ☐ YES ☐ NO	(b) IF YES, LAST PORT OF DEPARTURE	(c) IF YES, WHERE BOUND WHEN CASUALTY OCCURRED	
21(a) VESSEL LOCATION AT CASUALTY *(Latitude and longitude; distance and TRUE bearing from charted object; dock; anchored; etc.)*		(b) BODY OF WATER *(Geographical name)*	

22(a) RESULT OF CASUALTY: ☐ INJURY ☐ DEATH ☐ MISSING

(Complete INJURY or DEATH entries below, as appropriate)

(b) NATURE OF INJURY	(c) TOTAL DAYS INCAPACITATED
(d) REASON FOR DEATH	(e) LOCATION OF INDIVIDUAL AT DEATH
	(f) DATE OF DEATH

EDITIONS 4-61 AND 3-67 MAY BE USED (Over)

Fig. A.1 Report of Personal Injury or Loss of Life.

DAILY OPERATOR'S LOG

Lafayette CREWBOATS, INC.

P. O. BOX 3606 • LAFAYETTE, LOUISIANA 70501

BOAT: SHIP DATE 19

CONTRACTED TO: RIG LOCATION

TOTAL CUMULATIVE ENG. HRS

TIME	DEPARTURE (PLACE)	ARRIVAL (PLACE)	TIME	RUNNING TIME	STANDBY TIME	DESCRIPTION OF CARGO	NO PASSENGERS	REMARKS
			TOTAL RUNNING HOURS:					

ENGINE OPERATING DATA

OIL PRESSURE				
WATER TEMPERATURE				
HOURS SINCE LAST OIL CHANGE				
HOURS SINCE LAST OIL FILTER CHANGE				
HOURS SINCE LAST FUEL FILTER CHANGE				
BATTERY WATER LEVEL		CHECKED	ADDED	
ENGINE SMOKING	YES	NO	COLOR	
EXHAUST COOLING PUMP STRAINER		CHECKED	CLEANED	

HULL OPERATING DATA

CONDITION OF PROPELLER	O.K.	BENT
CONDITION OF PROPELLER SHAFT	O.K.	BENT
CONDITION OF RUDDER	O.K.	BENT
GREASED SHAFT STUFFING BOX	YES	NO
RUNNING LIGHTS	O.K.	
SPOT LIGHT	O.K.	
GENERAL CONDITION OF BOAT	O.K.	
DID YOUR RELIEF LEAVE BOAT CLEAN	YES	NO

REMARKS

DESCRIPTION OF REPAIRS PERFORMED THIS DAY:

BOAT OPERATOR

Fig. A.2 Daily Operator's Log.

Lafayette CREWBOATS, INC.

BOAT INSPECTION REPORT

DATE _____ M/V _____ SKIPPER _____

CO. _____ RIG# _____ LOCATION _____

SUPPLIES REQUIRED ON BOAT

TYPE	ON BD	LOR	$	TYPE	ON BD	LOR	$
B/P PARTS				OIL FILTER 117			
B/P BELTS				OIL FILTER 132			
ALT BELT				FUEL FILTER 540			
BULB 25W				FUEL FILTER 552			
BULB 68				PACKING			
BULB 1416				LOG BOOK			
BULB 1487				BUCKET			
BULB 4545				MOP			
WIPER BLADE				DECK BRUSH			
WIPER ARM				HANDLE			
COTTER KEY				DECK ROPE			
SHAFT KEY				PROPELLER			
SHAFT NUT				RUDDER			
JAM NUT				ANCHOR			
RUDDER BOLT				ANCHOR ROPE			
RUDDER O RING				GREASE GUN			

GLASS

	OK	BROKE		OK	BROKE
UCPS SLIDE			UCSS SLIDE		
UCPS FIXED			UCSS FIXED		
UCPS FRONT			UCSS FRONT		
UCPS REAR			UCSS REAR		
LCPS SLIDE			LCSS SLIDE		
LCPS FIXED			LCSS FIXED		
LCPS REAR			LCSS REAR		
UC CENTER			LC DOOR		

SEATS

	OK	TORN
UCPS		
UCSS		
LCPS		
LCSS		

INSTRUMENTS

WIPER _____

HEATER _____

RADAR _____

RADIO _____

COMPASS _____

OUTSIDE CABIN AND DECK

CABIN PAINT _____

HULL PAINT _____

STBD HANDRAIL _____

PORT HANDRAIL _____

FRONT BITS _____

REAR BITS _____

LIFE RING _____

LIFE RAFT _____

FLOATING LIGHT _____

NEEDS WELDING _____

WHERE? _____

CLEAN? _____

ENGINE ROOM

LEAKS FUEL? _____

LEAKS OIL? _____

LEAKS WATER? _____

WHEEL IN PLACE? _____

RUDDER IN PLACE? _____

ANCHOR IN PLACE? _____

CLEAN? _____

USCG REQUIREMENTS

YES	NO	ITEM	YES	NO	ITEM	NONE
		VALID CERTIFICATE OF NUMBERS			HORN OR WHISTLE ADEQUATE	
		NUMBERS PROPERLY DISPLAYED			BELL ADEQUATE	
		REQUIRED LIGHTS (NIGHT ONLY)			VENTILATION ADEQUATE	
		FLAME ARRESTOR PROPERLY INSTALLED			FUEL TANK COMPARTMENT	
		LIFESAVING DEVICES ADEQUATE			ENGINE COMPARTMENT	
		NUMBER OF APPROVED ACCEPTABLE LIFESAVING DEVICES ON BOARD			FIRE EXTINGUISHERS ADEQUATE	
		NUMBER OF NON APPROVED OR NOT SERVICABLE LIFESAVING DEVICES			NUMBER OF APPROVED SERVICABLE FIRE EXTINGUISHERS ON BOARD	
		RECKLESS OR NEGLIGENT OPERATION			NUMBER OF NON APPROVED OR NOT SERVICABLE FIRE EXTINGUISHERS	

Fig. A.3 Boat Inspection Report.

DEPARTMENT OF
TRANSPORTATION
U. S. COAST GUARD
CG-809 (Rev. 3-67)

NOTICE

STATION BILLS AND DRILLS

Regulation of the Commandant, United States Coast Guard, Contained in Parts 35, 78, and 97 of Chapter I, 46 C.F.R.

STATION BILLS

It shall be the duty of the master of every vessel carrying passengers and all other vessels of over 500 gross tons and subject to inspection to cause station bills to be prepared before the vessel sails, which shall be signed by the master who shall be responsible for their preparation. The station bills shall be posted in conspicuous places in several parts of the vessel, particularly in the crew's quarters, and shall contain full particulars of the signals which will be used for calling the crew to their stations for emergency duties. Special duties shall be allotted to each member of the crew, and the station bills shall show all these special duties and indicate the station to which each man shall go and the duties he has to perform. The special duties should, as far as possible, be comparable to the regular work of the individual. On passenger vessels, when the size of the crew will permit, several members of the crew shall be designated as an emergency squad and required to report to the bridge with certain equipment for instructions. The duties provided for by the station bills should include:

(1) The closing of airports, watertight doors, fire doors, scuppers, sanitary and other dischargos which lead through the vessel's hull below the margin line, etc., the stopping of fans and ventilating systems, and the operation of all safety equipment.

(2) The preparation and launching of lifeboats, liferafts, and buoyant apparatus.

(3) The extinction of fire.

(4) The muster of passengers:

(i) Warning the passengers.

(ii) Seeing that they are dressed and have put on their life preservers in a proper manner.

(iii) Assembling the passengers and directing them to the appointed stations.

(iv) Keeping order in the passageways and stairways and generally controlling the movement of the passengers.

(v) Seeing that a supply of blankets is taken to the lifeboats.

(5) The custody of the portable radio apparatus.

EMERGENCY SIGNALS

(1) Fire alarm signals.—(i) The general fire alarm signal shall be a continuous blast of the ship's whistle for a period not less than 10 seconds supplemented by the continuous ringing of the general alarm bells for not less than 10 seconds.

(ii) For dismissal from fire-alarm stations, the general alarm bells shall be sounded three times, supplemented by three short blasts of the whistle.

(2) Boat station or boat drill signals.—(i) The signal for lifeboat drill or lifeboat stations shall be more than six short blasts and one long blast of the whistle, supplemented by the same signal on the general alarm bells.

(ii) Where whistle signals are used for handling lifeboats, they shall be as follows:

(a) To lower lifeboats, one short blast of the whistle.

(b) To stop lowering the lifeboats, two short blasts of the whistle.

(c) For dismissal from lifeboat stations, three short blasts of the whistle.

(d) River Vessels. In the case of river vessels, the ship's bell may be used in lieu of the whistle.

(3) Other emergency signals.—The master of any vessel may establish such other emergency signal, in addition to the above, as will provide that all the officers and all the crew and passengers of the vessel will have positive and certain notice of the existing emergency.

EMERGENCY SQUAD SIGNALS

The nature of the signals or other means for assembling the emergency squad shall remain within the discretion of the master. Such signals shall not conflict with the navigational signals or signals used for a general alarm.

DRILLS, TESTS, AND INSPECTION

(1) The master shall be responsible for conducting a fire and boat drill at least once in every week. The fire and boat drill shall be conducted as if an actual emergency existed. All hands should report to their respective stations and be prepared to perform the duties specified in the station bill. Fire pumps shall be started and a sufficient number of outlets used to ascertain that the system is in proper working order. All reserve and safety equipment shall be brought from the emergency equipment lockers and the persons designated shall demonstrate their ability to use the equipment. All watertight doors which are in use while the vessel is underway and all fire doors shall be operated. Weather permitting, lifeboat covers and strongbacks shall be removed, plugs or caps put in place, boat ladders secured in position, painters led forward and landed, and other lifesaving equipment prepared for use. Lifeboat equipment shall be examined at least monthly to insure that it is complete. The motor and hand-propelling gear of each lifeboat, where fitted, shall be operated for at least 5 minutes. The passengers, if carried, shall be encouraged to fully participate in these drills and shall be instructed in the use of the life preservers. In port, every lifeboat shall be swung out, if practicable, and the unobstructed lifeboats shall be lowered to the water and the crew exercised in the use of the oars and other means of propulsion if provided for the lifeboat. Although all lifeboats may not be used in a particular drill, care shall be taken that all lifeboats are given consecutive use to ascertain that all lowering equipment is in proper order and the crew properly trained. The master shall be responsible that each lifeboat is lowered to the water at least once in each 3 months. When the vessel is underway, and weather permitting, all lifeboats shall be swung out to ascertain that the gear is in proper order. The person in charge of each lifeboat and liferaft shall have a list of its crew and shall see that the men under his command are acquainted with their duties. It shall be the duty of the master to ascertain that in connection with the boat drills, or at other times, each member of the crew except female members has been drilled and exercised in pulling oars in lifeboats at least once in each 3 months. In addition, the crew of each motor-propelled lifeboat shall demonstrate their ability in the working of the engine and handling of the lifeboat under power, and the crew of each hand-propelled lifeboat shall demonstrate their ability in the operation of the hand-propelling gear and the operation of the lifeboat under hand power within the same time.

(2) On passenger vessels in which the voyage exceeds 1 week in duration a complete lifeboat and fire drill shall be held before leaving port, and others thereafter at least once a week during the voyage. On all vessels on international voyage, other than a short international voyage, a muster of the passengers for fire and lifeboat drill shall be held within 24 hours after leaving port.

(3) On TANK and CARGO vessels in which more than 25 percent of the crew have been replaced at a port, a complete lifeboat and fire drill shall be held within 24 hours of leaving that port.

(4) All hinged or power-operated doors in main transverse bulkheads which are used for access while the vessel is being navigated, shall be opened and closed daily while the ship is at sea, in order to test the efficiency of the indicators and mechanisms.

(5) The watertight doors and all mechanisms and indicators connected therewith, and all valves, the closing of which is necessary to make a compartment watertight, shall be inspected at sea at least once a week.

LOGBOOK ENTRIES

The entries in the vessel's logbook relating to the exercise of the crew in fire and boat drills shall state the day of the month and the hour when so exercised, length of time of the drill, number on the lifeboats swung out and those lowered, number of lengths of boom used, together with a statement of the condition of all fire and lifesaving apparatus, and a report of the monthly examination of the lifeboat equipment. If any week the required drills are not held or only partial drills are held an entry shall be made stating the circumstances and extent of drills held.

PENALTY

For any neglect or omission on the part of the officer in command of such vessels to strictly enforce the provisions of this section, he may be proceeded against in accordance with the provisions of R.S. 4450, as amended, looking to a suspension or revocation of his license.

REQUIREMENTS

Three copies of Form CG-809 shall be furnished every vessel carrying passengers and one to all other vessels to which this section applies, to be framed under glass and posted in conspicuous places about the vessel.

PREVIOUS EDITIONS MAY BE USED

Fig. A.4 Form CG-809.

MARINE EMERGENCY AND DISTRESS INFORMATION SHEET
U. S. COAST GUARD

SPEAK SLOWLY AND CLEARLY

CALL:

1. If you are in DISTRESS, *(i.e. when threatened by grave and imminent danger)* transmit the International Distress Call on 2182 kc/s - "MAYDAY MAYDAY MAYDAY THIS IS *(Your vessel's call and name repeated THREE times)*".*
2. If you need INFORMATION OR ASSISTANCE FROM THE COAST GUARD *(other than in a distress)*, call COAST GUARD on 2182 kc/s, *(the International Distress and Calling Frequency)*.

* The Radiotelephone Alarm Signal *(if available)* should be transmitted prior to the Distress Call for approximately one minute. The Radiotelephone Alarm Signal consists of two audio tones, of different pitch, transmitted alternately. Its purpose is to attract the attention of persons on watch and shall only be used to announce that a distress call or message is about to follow.

IF ABOARD VESSEL IN TROUBLE - give:

1. WHO you are *(your vessel's call and name)*.
2. WHERE you are *(your vessel's position in latitude/longitude or true bearing and distance in nautical miles from a widely known geographical point - local names known only in the immediate vicinity are confusing)*.
3. WHAT is wrong *(nature of distress or difficulty, if not in distress)*.
4. Kind of assistance desired.
5. Number of persons aboard and condition of any injured.
6. Present seaworthiness of your vessel.
7. Description of your vessel - length, type, cabin, masts, power, color of hull, superstructure, and trim.
8. Your listening frequency and schedule.

IF OBSERVING ANOTHER VESSEL IN DIFFICULTY - give:

1. Your position and the bearing and distance of the vessel in difficulty.
2. Nature of distress or difficulty, if not in distress.
3. Description of the vessel in distress or difficulty, if not in distress *(see Item 7 above)*.
4. Your intentions, course, and speed, etc.
5. Your radio call sign, name of your vessel, listening frequency, and schedule.

***NOTE:** The international signal for an aircraft that wants to direct a surface craft to a distress is: Circling the surface craft, opening and closing the throttle or changing propeller pitch (noticeable by change in sound) while crossing ahead of the surface craft, and proceeding in the direction of the distress. If you receive such a signal, you should follow the aircraft. If you cannot do so, try to inform the aircraft by any available means. If your assistance is no longer needed, the aircraft will cross your wake, opening and closing the throttle or changing propeller pitch. If you are radio equipped, you should attempt to communicate with the aircraft on 2182 kc/s when the aircraft makes the above signals or makes any obvious attempt to attract your attention. In the event that you cannot communicate by radio, be alert for a message block dropped from the aircraft.*

NOTIFY THE COAST GUARD PROMPTLY AS SOON AS THE EMERGENCY TERMINATES

POST NEAR YOUR RADIO FOR READY REFERENCE

TREAS. DEPT., USCG, CG-3892 (Rev. 1-62)
PREVIOUS EDITIONS ARE OBSOLETE

GPO : 1962 O - 632444

Fig. A.5 Marine Emergency and Distress Information Sheet.

OFFICIAL LOGBOOK

Supplied Gratuitously by the Government of the United States to American Vessels in the Foreign Trade and the Trade Between the Atlantic and Pacific Ports of the United States

NAME OF SHIP	OFFICIAL NUMBER
PORT OF REGISTRY	NET TONNAGE
NAME OF MASTER	MASTER'S Z/BK NUMBER
NATURE OF VOYAGE OR EMPLOYMENT	CLASS OF SHIP

TABLE OF CONTENTS

Item	Page
Draft Record	2
Maintenance of Watertight Integrity of the Ship	3
Drills and Inspections	5
Crew List and Report of Character	10
Laws Relating to Log-Books	18
Miscellaneous Entries	20
Slop and Cash Accounts	70

LOAD LINES FOR VESSELS (46 USC 85)—See Page 2

SEC. 85. Load lines are hereby established for the following vessels: (a) Merchant vessels of one hundred and fifty gross tons or over, loading at or proceeding to sea from any port or place within the United States or its possessions for a foreign voyage by sea, or arriving within the jurisdiction of the United States or its possessions from a foreign voyage by sea, in both cases the Great Lakes excepted. (b) Merchant vessels of the United States of one hundred and fifty gross tons or over, loading at or proceeding to sea from any foreign port or place for a voyage by sea, the Great Lakes excepted.

SEC. 85e. It shall be the duty of the master of every vessel subject to Sections 85–85g of this Title and to the regulations established thereunder . . . before departing from her loading port or place for a voyage by sea, to enter in the official logbook of such vessel a statement of the position of the load line mark applicable to the voyage in question and the actual drafts forward and aft at the time of departing from port as nearly as the same can be ascertained.

SEC. 85g. (b) If the master of any vessel subject to Sections 85–85g of this Title and to the regulations established thereunder, . . . shall fail, before departing from her loading port or place, to enter in the official logbook of such vessel the statement required by section 85e of this Title, he shall for each offense be liable to the United States in a penalty of $500. (The Commandant, United States Coast Guard may, in his descretion, remit or mitigate any penalty imposed under this paragraph.)

EXCERPTS OF U.S. COAST GUARD REGULATIONS—See Page 2
Concerning Load Lines and Implementing the International Convention for the Safety of Life at Sea, 1960

The master of any vessel, at the time of departure from a port, on an ocean, coastwise or Great Lakes voyage, shall insert in the official logbook a statement of the position of the load line mark (for cargo vessels) or the subdivision load line mark (for passenger vessels), port and starboard, in relation to the surface of the water in which the vessel is then floating; and the drafts of the vessel, forward and aft.

Fig. A.6 Page 1 of Official Logbook.

WEEKLY CHECK LIST FOR VESSELS

(To be turned in with logs - Copy left on board)

NAME OF VESSEL _____ DATE _____

The following equipment has been operated and found to be in the following condition:

	GOOD	NEED REPAIRS - REMARKS
RADAR		
RADIO		
PORT MAIN ENGINE AND CLUTCH		
STBD. MAIN ENGINE AND CLUTCH		
BILGES CHECKED		
AIR CONDITION		
WALK-IN FREEZER OR FREEZER AND REFRIGERATOR		
STUFFING BOX (SHAFT & RUDDER)		
LIFE SAVING EQUIPMENT (RINGS, FLOATS AND JACKETS)		
BILGE AND FIRE PUMP		
FIRE EXTINGUISHERS		
BALLAST PUMP		
FUEL TRANSFER PUMP		
HYDRAULIC PUMPS FOR STEERING MECHANISM		
ANCHOR WINCH AND CHAIN		
WATER TIGHT DOORS		
AIR COMPRESSORS		
POTABLE WATER PUMP SANITARY PUMP		
BATTERY CHARGER		
ENGINE ROOM BLOWERS		
BATTERIES - CHECK WATER		
RUNNING LIGHTS		
ALL ENGINE ALARMS		
ALL ENGINE FOUNDATION BOLTS		
CHECK ALL FUEL TANKS FOR WATER (Check with water finding paste)		
ALL ENGINE AIR FILTERS		
BROKEN EXHAUST		
SIGHT GLASS CLEAN		
DATE OIL FILTERS LAST CHANGED		
DATE FUEL FILTERS LAST CHANGED		
VOLTAGE AND CYCLE PROPERLY SET (show readings)		

SIGNED: CAPTAIN _____ ENGINEER _____

Fig. A.7 Weekly Check List for Vessels.

DAILY ENGINE ROOM LOG

Offshore Crews, Inc. M/V LOCATION DATE

Main Engine Pressures — PORT STBD

Lube Oil

Jacket Water

Fuel Oil

Oil Press Filter (Inlet)

Oil Press Filter (Outlet)

Water Press in Exch. or After Cooler — PORT STBD

Main Engine Temperatures

Water in Eng.

Water out Eng.

Water in Exch.

Water out Exch.

Lube Oil in Eng.

Lube Oil out Eng.

Air Press on Clutch (Lbs)

Air Press Main Tanks (Lbs)

Lube Oil in Filter

Intake Manifold Temp.

Exhaust Manifold Temp.

Engine Jacket Water Temp.

Engine Cylinder Readings — LEFT BANK 1 2 3 4 5 6 7 8 9 10 11 — RIGHT BANK 12 13 14 15 16 17 18 19 20

Cylinder Temp (Port)

Cylinder Temp. (Stbd)

AIR COMPRESSORS — HRS RUN TODAY | HRS ON ENGINE | TOTAL | HRS ON OIL | DATE OIL CHANGED | WATER DRAINED

LUBE OIL — USED | RECEIVED | TOTAL | ON BOARD

FUEL OIL — USED | RECEIVED | TOTAL | ON BOARD

REDUCTION GEAR — WATER TEMP | OIL TEMP | OIL PRESS | OIL PRESS ENGAGED | HRS ON GEAR | TOTAL | OIL USED | HRS ON OIL | DATE OIL CHANGED | DATE OIL FILTER CHANGED

MAIN ENGINES OIL CHANGE & FILTERS — HRS RUN TODAY | TOTAL | HRS ON OIL | OIL USED | DATE OIL CHANGED | DATE OIL FILTER CHANGED | R P M

BOW THRUSTER ENGINE — HRS RUN TODAY | HRS ON ENGINE | TOTAL | HRS ON OIL | WATER TEMP | OIL PRESS | OIL USED | DATE OIL CHANGED | DATE OIL FILTER CHANGED

BOW COMPRESSOR ENGINE — HRS RUN TODAY | HRS ON ENGINE | TOTAL | HRS ON OIL | WATER TEMP | OIL PRESS | OIL USED | DATE OIL CHANGED | DATE OIL FILTER CHANGED

Generators — OIL PRESS | WATER TEMP | RPM | CYCLE | AMPS | VOLTS | HRS ON ENGINE | TOTAL | HRS ON OIL | DATE OIL CHANGED | OIL USED | DATE OIL FILTER CHANGED | DATE F. O. FILTER CHANGED | DATE SALINOMETER INSP. OR CHANGED | DATE ZINCION & ANNATURE PUMP & CLEANED

Port

Stbd

REMARKS —

CAPT

ENGINEER

DAILY CHECK LIST

All Lube & Water Connections ( )

All Air Lines ( )

Drain Water From Air Storage Tanks ( )

Drain Water From Fuel Oil Day Tanks ( )

Drain Water From Traps & Strainers ( )

Close All Valves Not In Use ( )

WEEKLY CHECK LIST REMINDER

Operate Anchor Winch, Date_____

Greased Anchor Winch, Date_____

Greased Steering System, Date_____

Check Water Level All Batteries, Date_____

Inspect & Service Air Filters, Date_____

Check All Alarms, Date_____

Clean Air Conditioner Filters, Date_____

Fig. A.8 Daily Engine Room Log.

DEPARTMENT OF TRANSPORTATION

UNITED STATES COAST GUARD

CG 701
(Rev. 1-67)

FORECASTLE CARD

Notice is hereby given that section 4510 of the U. S. Revised Statutes (U. S. C., title 46, sec. 577) makes it obligatory on the part of the master of a merchant vessel of the United States, at the commencement of every voyage or engagement, to cause a legible copy of the agreement (omitting signatures) to be placed or posted up in such part of the vessel as to be accessible to the crew, under a penalty not exceeding ONE HUNDRED DOLLARS.

ARTICLES OF AGREEMENT BETWEEN MASTER AND SEAMEN IN THE MERCHANT SERVICE OF THE UNITED STATES

Required by act of Congress, title LIII, Revised Statutes of the United States (U. S. C., title 46, chap. 18)

Office of the U. S. Shipping Commissioner for the Port of _____, 19____

IT IS AGREED between the master and seamen, or mariners, of the _____

_____ *of which* _____

is at present master, or whoever shall go for master, now bound from the port of [1] _____, *to*

_____

_____

_____

_____

and such other ports and places in any part of the world as the master may direct, and back to a final port of discharge in the United States, for a term of time not exceeding _____ *calendar months.* [2]

And the said crew agree to conduct themselves in an orderly, faithful, honest, and sober manner, and to be at all times diligent in their respective duties, and to be obedient to the lawful commands of the said master, or of any person who shall lawfully succeed him, and of their superior officers, in everything relating to the vessel, and the stores and cargo thereof, whether on board, in boats, or on shore; and to perform all requisite services to be duly performed both under weather bowsing regular as may be the said crew, as required. Their common working hours, when in port, are from [illegible] according to the following watches. And it is hereby agreed that any embezzlement or willful or negligent destruction of any part of the vessel's cargo or stores shall be made good to the owner out of the wages of the person guilty of the same. And if any persons enters herewith as qualified for a duty which he proves himself unqualified to perform, his wages shall be reduced in proportion to his incompetency. And it is also agreed that if any member of the crew considers himself to be aggrieved by any breach of the agreement or otherwise, he shall represent the same to the master or officer in charge of the ship in a quiet and orderly manner, who shall thereupon take such steps as the case may require.—R. S. U., title 46, section 713.

GOING ON SHORE IN FOREIGN PORTS IS PROHIBITED EXCEPT BY PERMISSION OF THE MASTER

NO DANGEROUS WEAPONS[3] OR GROG ALLOWED, AND NONE TO BE BROUGHT ABOARD BY THE CREW

SCALE OF PROVISIONS to be allowed and served out to the crew during the voyage in addition to the daily issue of lime and lemon juice and so far, or other antiscorbutics in any case required by law

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Water	quarts	6	6	6	6	6	6	6
Bread	pound	1½	1½	1½	1½	1½	1½	1½
Beef, salt	pounds			1¼				1¼
Pork, salt	pounds		1		1		1	
Flour	pound	½		½		½		
Dried beans	pound	½			1			
Potatoes, canned	pound	1	1	1	1	1	1	1
Fresh bread	pounds	1¼	1¼	1¼	1¼	1¼	1¼	1¼
Fish, dry, preserved, or fresh	pound	½	1	1	1	1	1	
Molasses or fruits	pound						½	
Preserved meats	pound	½				½		
Rice	pint		½	½				
Tea	pint		½		½			½

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Coffee (green berry)	ounces	1½	1½	1½	1½	1½	1½	1½
Tea	ounces	½	½	½	½	½	½	½
Sugar	pounds	½	½	½	½	½	½	½
Molasses	pint							
Dried fruit	pounds		½		½		½	
Pickles	pint			½				½
Vinegar	pint							
Corn meal	pounds	½				½		
Onions	pounds	½	½	½	½	½	½	½
Lard	pounds							
Potatoes	pounds	½	½	½	½	½	½	½
If canned, pepper, and salt sufficient for seasoning								

SUBSTITUTES

One pound of flour daily may be substituted for the daily ration of bread or fresh bread; two ounces of desiccated vegetables for one pound of potatoes or yams; six ounces of hominy, cabin, or granulated wheat, or corn meal, or barley, for six ounces of rice; six ounces of canned vegetables for one-half pound of canned tomatoes; one pound of an equal mixture of the two last-named articles for one daily ration of canned or preserved meat; one pint of cocoa for one pound of tea; six ounces of condensed milk for three ounces of dried fruit; one-half ounce of lime juice for one daily ration of vinegar; four ounces of molasses or sugar for one pound of potatoes; one pound of canned fish for three ounces of dried fish; one-half ounce of lime juice for one daily ration of canned or preserved meat; one pint of corn meal, or two ounces of pickled cabbage for four ounces of fresh cabbage.

Where the vessel is in part used it is possible to obtain the same, one and one-half pounds of fresh yams shall be substituted for the daily rations of salt and smoked meats; one-half pound of green cabbage for one ounce of desiccated vegetables; one-half pound of fresh fruit for one ounce of dried fruit. Fresh fruit and vegetables shall be served twice in port if obtainable. The common shall have the option of exchanging this, their weather every provision, but that right of every thirty he exercised this foregoing mode of provisions.

The foregoing scale of provisions shall be inserted in every article of agreement, and shall not be reduced by any contract, except as above, and a copy of the same shall be posted in a conspicuous place in the galley and in the forecastle of each vessel.

It is also agreed that [4] _____

_____

_____

_____

_____

IN WITNESS WHEREOF the said parties have subscribed their names hereto on the days against their respective signatures mentioned.

_____, *Master, of* _____
(Give address)

on the _____ *day of* _____, *19*____

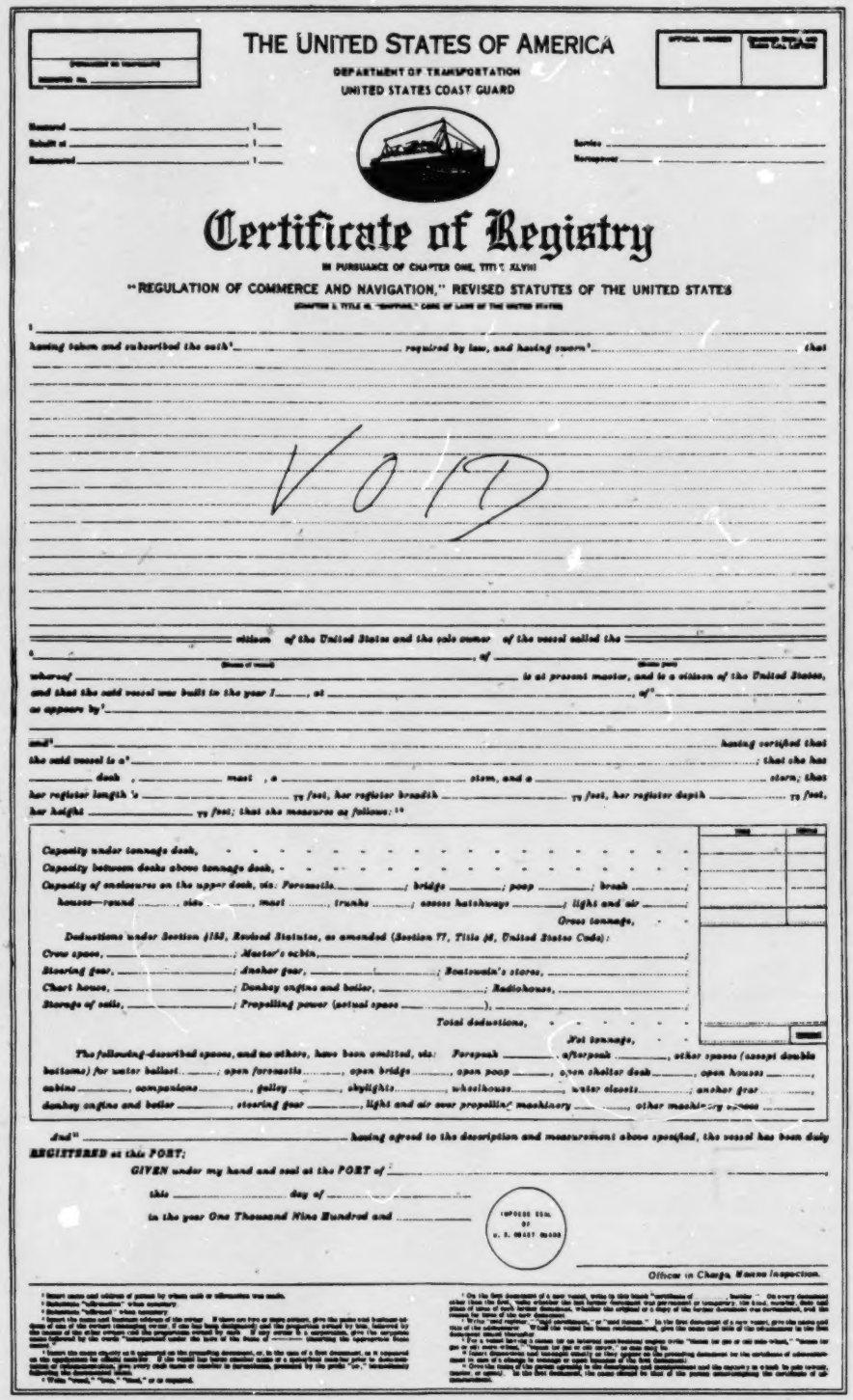
The authority of the owner or agent for the allotments mentioned in these articles is in my possession.

_____
Shipping Commissioner or Consular Officer.

The Shipping Commissioner or Consular Officer will sign if such authority has been produced and will strike out in ink if it has not.

1. State the voyage is to be described, and the places named at which the ship is to touch or, if that cannot be done, the general nature and probable length of the voyage is to be stated, and the port or country at which the voyage is to terminate.
2. If more words are used necessary they must be written out.
3. By sec. R. S. U. S., title 46, sec. 713, prohibiting the wearing of swords during an adjustment, and the master between the crew of this law.
4. Here any other stipulations may be inserted to which the parties agree, and which are not contrary to law.

Fig. A.9 Forecastle Card.



THE UNITED STATES OF AMERICA

DEPARTMENT OF TRANSPORTATION

UNITED STATES COAST GUARD

Certificate of Registry

IN PURSUANCE OF CHAPTER ONE, TITLE XLVIII

"REGULATION OF COMMERCE AND NAVIGATION," REVISED STATUTES OF THE UNITED STATES

V 0 19

Fig. A.10 (a-c) Certificate of Registry. (a)

Official No. .....
CG-1265

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

.....
(Permanent or temporary)

CERTIFICATE OF REGISTRY

No. .....

OF THE

.....

CALLED THE

.....

OF

.....

..... *gross*, ... *net*

ISSUED AT THE

Port of .....

....., *19*.....

WHERE SURRENDERED:

.....

WHEN SURRENDERED:

.....

WHY SURRENDERED:

.....

.....

.....

.....
Documentation Officer.

(1) PREFERRED MORTGAGE ENDORSEMENT

(MERCHANT MARINE ACT, 1920, SEC. 30, 41 U. S. C., TITLE 46, CHAPTER 20)

MORTGAGE DESCRIPTION
(SUBSECTION Dc)

Mortgagor .....

Mortgagee .....

Endorsed ....., *19*....., *at* .....*m.*

Total amount, $ .....

Date of maturity ....., *19*.....

Discharge amount, $ .....

Port of .....

[SEAL]

.....
Documentation Officer.

MORTGAGE DISCHARGE
(SUBSECTION Gc)

Port of .....

....., *19*.....

The sum of $ ..... *has been paid on the above-described mortgage, the certificate of such discharge being filed in this office*

....., *19*....., *at* ..... *m.*

[SEAL]

.....
Documentation Officer.

(2) PREFERRED MORTGAGE ENDORSEMENT

(MERCHANT MARINE ACT, 1920, SEC. 30, 41 U. S. C., TITLE 46, CHAPTER 20)

MORTGAGE DESCRIPTION
(SUBSECTION Dc)

Mortgagor .....

Mortgagee .....

Endorsed ....., *19*....., *at* .....*m.*

Total amount, $ .....

Date of maturity ....., *19*.....

Discharge amount, $ .....

Port of .....

[SEAL]

.....
Documentation Officer.

MORTGAGE DISCHARGE
(SUBSECTION Gc)

Port of .....

....., *19*.....

The sum of $ ..... *has been paid on the above-described mortgage, the certificate of such discharge being filed in this office*

....., *19*....., *at* ..... *m.*

[SEAL]

.....
Documentation Officer.

GPO 940-776

A.10 b

ENDORSEMENTS OF CHANGE OF MASTERS

(1)
Port of _____, _____, 19____

_____, having taken the oath required by law, is at present master of the within-named vessel, vice _____

_____

_____ Documentation Officer.

(2)
Port of _____, _____, 19____

_____, having taken the oath required by law, is at present master of the within-named vessel, vice _____

_____

_____ Documentation Officer.

(3)
Port of _____, _____, 19____

_____, having taken the oath required by law, is at present master of the within-named vessel, vice _____

_____

_____ Documentation Officer.

(4)
Port of _____, _____, 19____

_____, having taken the oath required by law, is at present master of the within-named vessel, vice _____

_____

_____ Documentation Officer.

(5)
Port of _____, _____, 19____

_____, having taken the oath required by law, is at present master of the within-named vessel, vice _____

_____

_____ Documentation Officer.

(6)
Port of _____, _____, 19____

_____, having taken the oath required by law, is at present master of the within-named vessel, vice _____

_____

_____ Documentation Officer.

(7)
Port of _____, _____, 19____

_____, having taken the oath required by law, is at present master of the within-named vessel, vice _____

_____

_____ Documentation Officer.

(8)
Port of _____, _____, 19____

_____, having taken the oath required by law, is at present master of the within-named vessel, vice _____

_____

_____ Documentation Officer.

(9)
Port of _____, _____, 19____

_____, having taken the oath required by law, is at present master of the within-named vessel, vice _____

_____

_____ Documentation Officer.

(10)
Port of _____, _____, 19____

_____, having taken the oath required by law, is at present master of the within-named vessel, vice _____

_____

_____ Documentation Officer.

(11)
Port of _____, _____, 19____

_____, having taken the oath required by law, is at present master of the within-named vessel, vice _____

_____

_____ Documentation Officer.

(12)
Port of _____, _____, 19____

_____, having taken the oath required by law, is at present master of the within-named vessel, vice _____

_____

_____ Documentation Officer.

(13)
Port of _____, _____, 19____

_____, having taken the oath required by law, is at present master of the within-named vessel, vice _____

_____

_____ Documentation Officer.

(14)
Port of _____, _____, 19____

_____, having taken the oath required by law, is at present master of the within-named vessel, vice _____

_____

_____ Documentation Officer.

(15)
Port of _____, _____, 19____

_____, having taken the oath required by law, is at present master of the within-named vessel, vice _____

_____

_____ Documentation Officer.

(16)
Port of _____, _____, 19____

_____, having taken the oath required by law, is at present master of the within-named vessel, vice _____

_____

_____ Documentation Officer.

(17)
Port of _____, _____, 19____

_____, having taken the oath required by law, is at present master of the within-named vessel, vice _____

_____

_____ Documentation Officer.

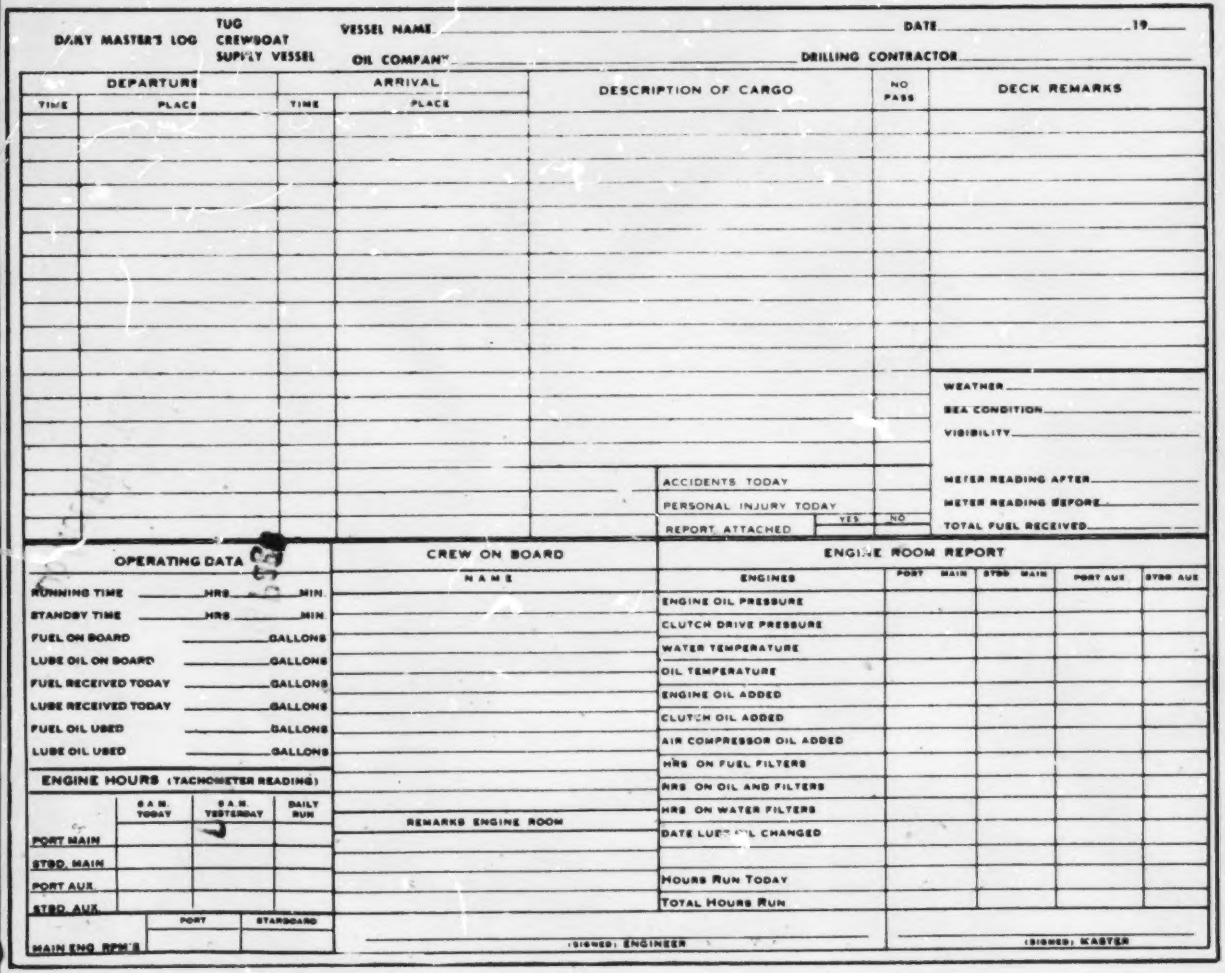
(18)
Port of _____, _____, 19____

_____, having taken the oath required by law, is at present master of the within-named vessel, vice _____

_____

_____ Documentation Officer.

A. 10c



DAILY MASTER'S LOG — TUG / CREWBOAT / SUPPLY VESSEL

VESSEL NAME _____ DATE _____ 19____

OIL COMPANY _____ DRILLING CONTRACTOR _____

DEPARTURE TIME	DEPARTURE PLACE	ARRIVAL TIME	ARRIVAL PLACE	DESCRIPTION OF CARGO	NO PASS	DECK REMARKS

ACCIDENTS TODAY

PERSONAL INJURY TODAY

REPORT ATTACHED — YES / NO

WEATHER _____

SEA CONDITION _____

VISIBILITY _____

METER READING AFTER _____

METER READING BEFORE _____

TOTAL FUEL RECEIVED _____

OPERATING DATA

RUNNING TIME _____ HRS _____ MIN

STANDBY TIME _____ HRS _____ MIN

FUEL ON BOARD _____ GALLONS

LUBE OIL ON BOARD _____ GALLONS

FUEL RECEIVED TODAY _____ GALLONS

LUBE RECEIVED TODAY _____ GALLONS

FUEL OIL USED _____ GALLONS

LUBE OIL USED _____ GALLONS

ENGINE HOURS (TACHOMETER READING)

	0 A.M. TODAY	0 A.M. YESTERDAY	DAILY RUN
PORT MAIN			
STBD. MAIN			
PORT AUX.			
STBD. AUX.			

MAIN ENG. RPM'S	PORT	STARBOARD

CREW ON BOARD

NAME

REMARKS ENGINE ROOM

(SIGNED) ENGINEER

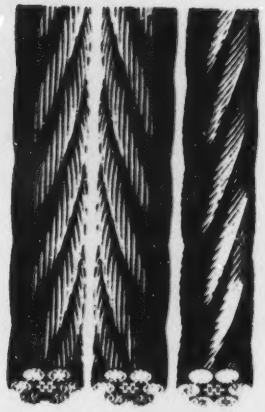
ENGINE ROOM REPORT

ENGINES	PORT MAIN	STBD MAIN	PORT AUX	STBD AUX
ENGINE OIL PRESSURE				
CLUTCH DRIVE PRESSURE				
WATER TEMPERATURE				
OIL TEMPERATURE				
ENGINE OIL ADDED				
CLUTCH OIL ADDED				
AIR COMPRESSOR OIL ADDED				
HRS ON FUEL FILTERS				
HRS ON OIL AND FILTERS				
HRS ON WATER FILTERS				
DATE LUBE OIL CHANGED				
HOURS RUN TODAY				
TOTAL HOURS RUN				

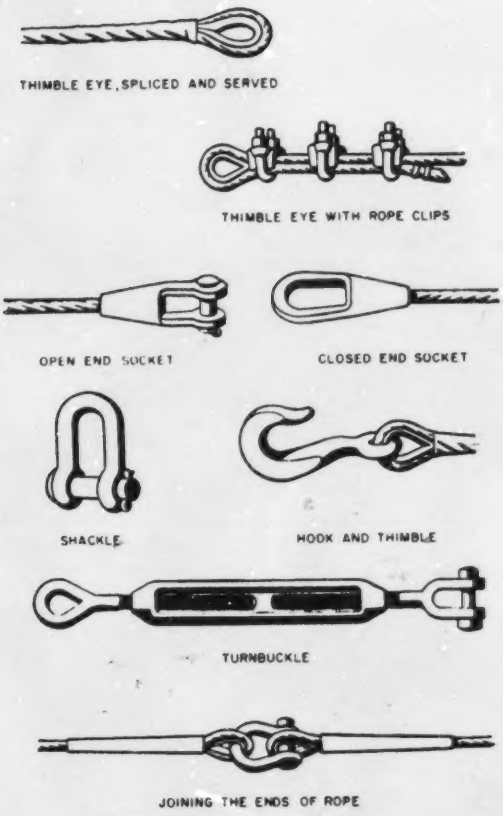
(SIGNED) MASTER

Fig. A.11 Daily Master's Log.

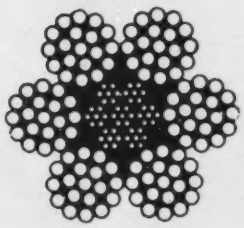
PLATES 1-7



1. Wire rope lay.

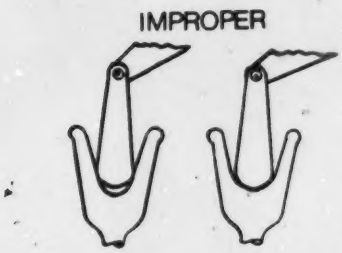


2. End fittings for wire rope.



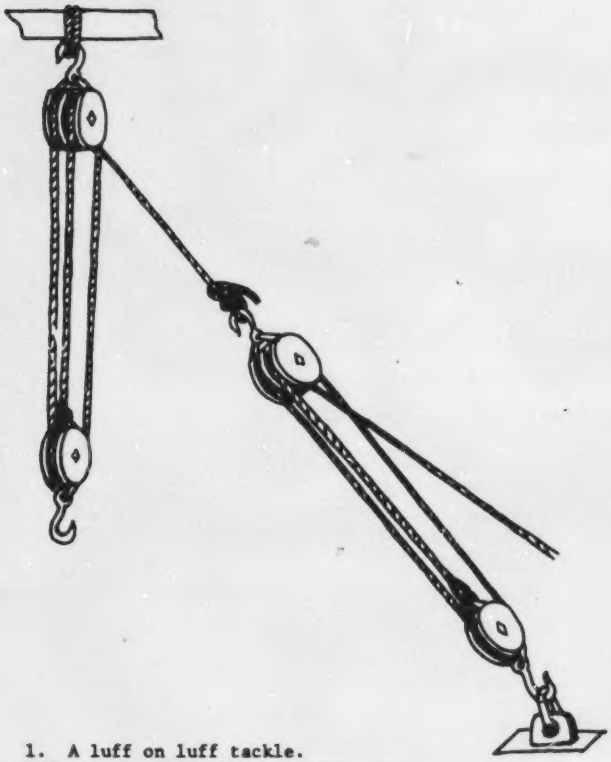
6 x 25 FW PRF RLL XIP IWRC

3. How to describe any wire rope. Illustration shows a 6-strand rope with 25 wires in each strand (6x25) of filler wire construction (FW). The grade of wire used is Extra Improved Plow Steel (XIP). The strands are preformed (PRF) in a helical pattern before being laid Right Lang Lay (RLL) around an independent wire rope core (1 WRC).



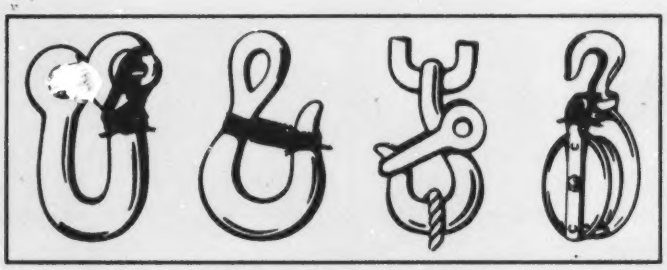
4. How to measure a sheave groove for correct diameter wire rope.

Plate 1



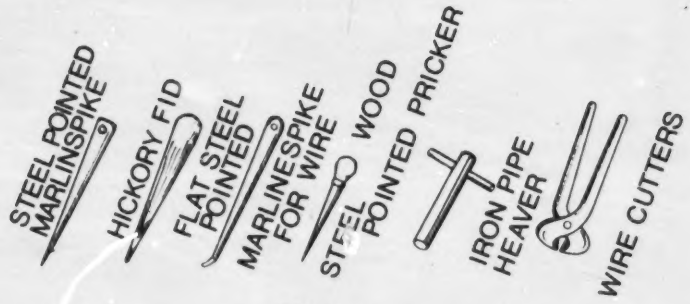
1. A luff on luff tackle.
Mechanical advantage is 12.

2. A stopper on a line with a strain on it.



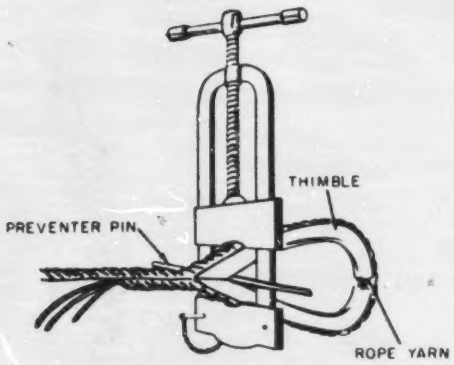
3. Methods of mousing.

Plate 2.

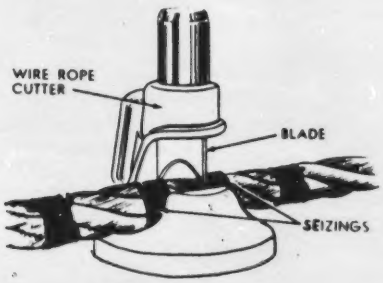


TOOLS

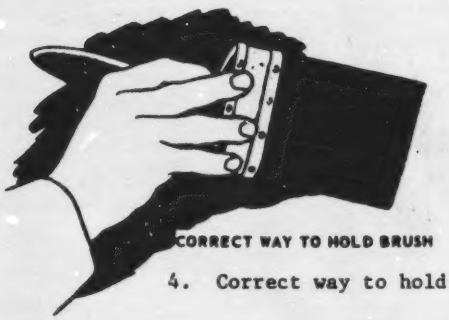
1. Tools used in working with wire rope.



2. Rigger's vise.



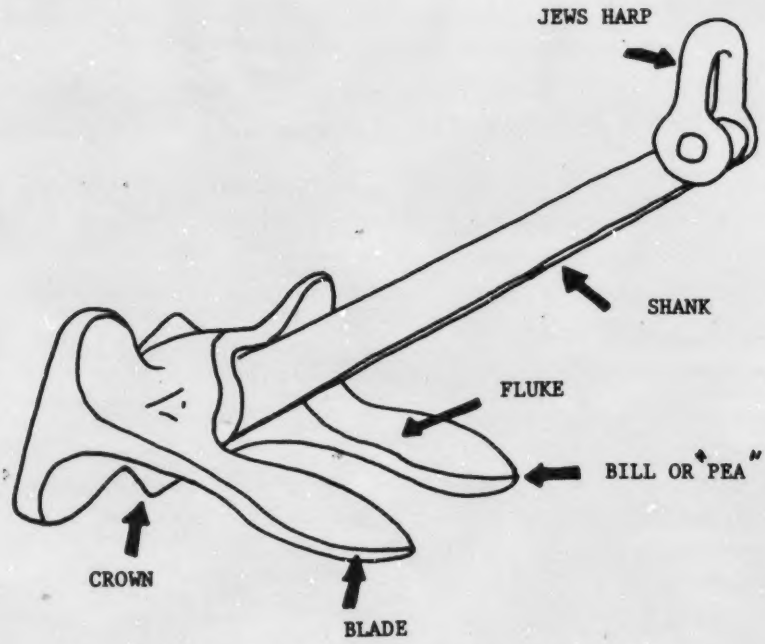
3. Wire rope cutter.



4. Correct way to hold brush.

5. Types of paint brushes.

Plate 3.



1. Nomenclature of a stockless anchor.

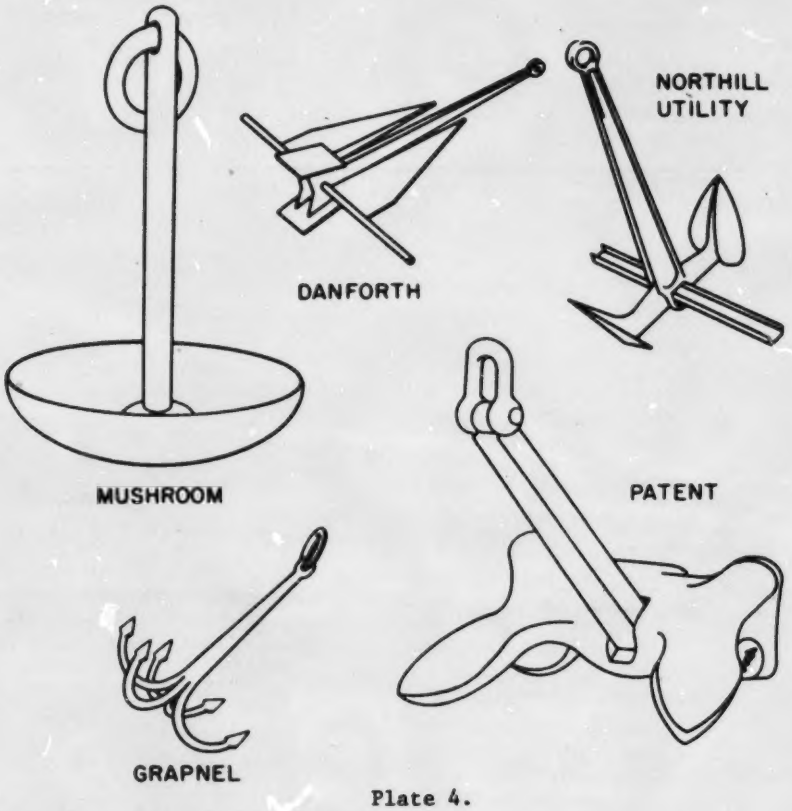
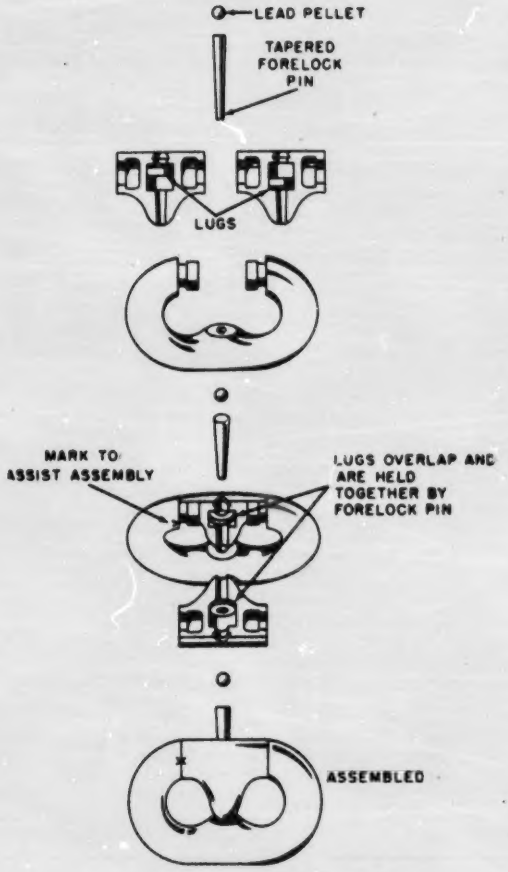
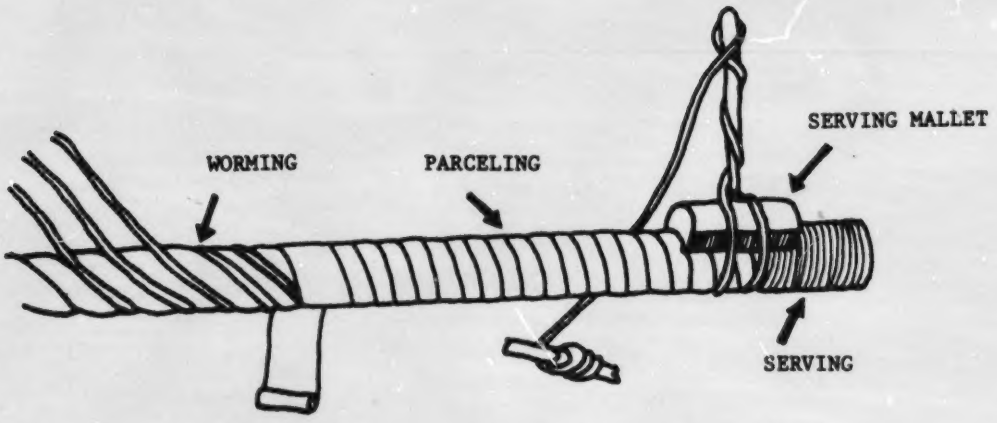


Plate 4.

2. Types of anchors.

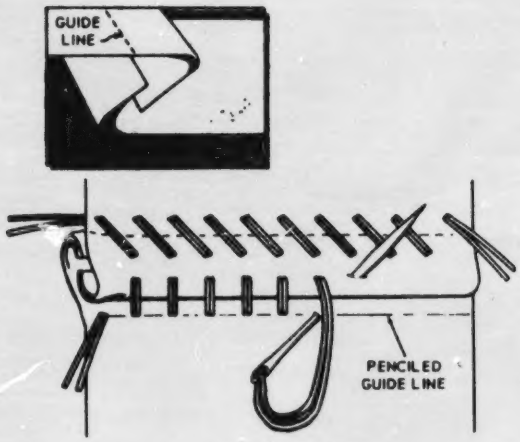


1. A detachable link.



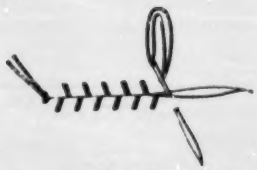
2. Worming, parceling, and serving.

Plate 5.

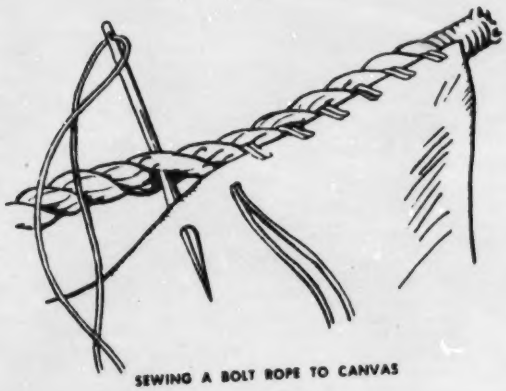


1. Flat stitch.

2. Herringbone stitch.



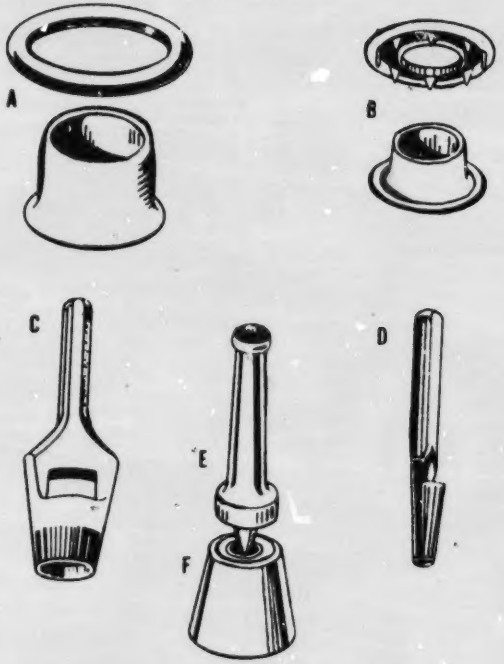
3. Baseball stitch.



4. Round stitch.

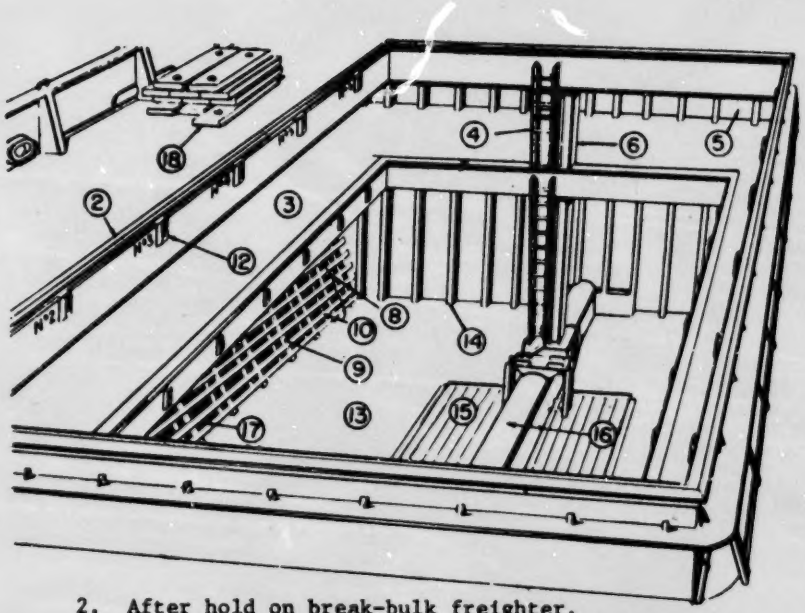
5. Sewing palm.

Plate 6.



198

1. A--eyelet and ring type grommet; B--spur type grommet; C--double bow type cutting punch; D--single bow type cutting punch; E--punch; F--die.



2. After hold on break-bulk freighter.

1 Removable beam	7 Ring	13 Lower hold
2 Cargo hatch coaming	8 Flare	14 Stiffener
3 Tween deck	9 Frame	15 Ceiling planks
4 Hatch ladder	10 Sweat batten	16 Shaft alley
5 Bulkhead	11 Tank top	17 Skin
6 Stanchion	12 Beam socket	18 Hatchboards

Plate 7

GLOSSARY OF NAUTICAL TERMS

abaft (or aft) - astern; toward the stern
abeam - at right angles to the center line of a vessel, and not on the vessel
aboard - on, or in, a vessel
abreast - side by side, on line with the beam
adrift - loose from moorings; out of place
ahead - forward of the bow
aloft - above the pilot house; overhead
amidships - in the middle part of a vessel
anchor ball - black ball hoisted aloft indicating the vessel is at anchor
anchor light - white light displayed by the vessel at anchor
anemometer - instrument used to measure wind velocity
aneroid barometer - instrument used to measure atmospheric pressure, which indicates a change in the weather
anticorrosive paint - applied to a vessel's bottom to prevent corrosion
antifouling paint - applied over anticorrosive paint to prevent or inhibit the growth of marine organisms
astern - toward the stern
athwart or antithwartship - at a right angle to the center line of the ship
avast - to stop or cease
awash - having water over the deck of the boat
azimuth - the bearing or direction of an object from the observer measured as an angle clockwise from true north

backstay - a line or stay supporting a mast from aft
backwash - water thrown astern by the vessel's propellers
ballast - heavy weight in hold of vessel for stability; also, a vessel is said to be in ballast when she has no cargo--only ballast
ballast tanks - tanks located in the vessel to keep her on an even keel
band - to make fast, secure a line to a bitt or cleat, or another line
barnacle - small marine animal found growing on a vessel bottom, piers and pilings
batten down - to cover an object and fasten it down securely
beam - the widest part of a vessel; the width of a vessel
beams - athwartship members of ship's frame which support the decks
bear - to be in a certain direction from the observer, i.e., "bear left" or "bear right"
bearing - direction expressed in a compass point or degrees
becket - a rope eye or loop

belay - to make a line fast or secure by winding it in figure-eight fashion around a bitt or cleat; also to stop or cancel an order
below - below the main deck
bend - a knot by which one rope is fastened to another
berth - a bunk for sleeping; also the space for a vessel to anchor or moor along a dock or pier
bight - a bend or loop in a rope
bilge - the lowest part of the vessel under the floor plates
binnacle - a stand for ship's compass
bitt - a steel post set in deck for fastening lines
bitter end - the inboard end of a line or chain
block - a device similar to a pulley or sheave with one or more grooved wheels through which the line or cable runs. The block is fitted with a hook or eye as required. They are made in many sizes and types to suit their use.
boathook - wooden or aluminum pole with a hook on one end
boat printer - short line attached to the bow of a boat or skiff used to secure it or make it fast. Also, called a bow painter. These are used on a small boat.
bollard - vertical posts, usually steel pipe, located on a pier and used to secure docking or mooring lines from a vessel
bos'ns chair - seat made of a short board and rope like a swing, which can be suspended over the side or from rigging overhead
bottom plating - the part of the shell plating below the water line
bow - forward part of a vessel
bowline - a knot used to make an eye in the end of a rope
bow lines - mooring or docking lines put out from the vessel's bow
boxing the compass - naming the 32 points of the compass in sequence from North, to East, South, West, and back to North
breast lines - lines leading at a right angle to the vessel
bridge - the upper deck from which the vessel is navigated
bridle - a yoke or span of wire rope or chain with both ends secured; usually secured to a barge or vessel to be towed
bulkhead - wall partition in a vessel separating compartments
bullrope - a line or rope used to lift or pull an object without using a block to multiply lifting or pulling power
bulwark - upper frames and side plating above and around the deck
bunker - compartment for storing fuel below decks; fuel tanks
buoy - floating marker moored to the bottom

cable markings - system of color coding anchor chain with paint in order to identify length
cardinal point - one of four principal points of the compass, North, South, East, or West
cargo gate - removable section in bulwarks of supply vessels

catch a turn - to take a turn with a line around a bitt or capstan, usually for holding temporarily
centerline - imaginary straight line running from vessel's bow to stern
chafe - to wear the surface of line, rope, or wire
chafing gear - canvas or other wrapping to prevent chafing
chain stopper - short length of chain rigged to secure an anchor, heavy hose, or other gear in order to be able to release it quickly and easily
chain hoists - light mechanical units that one or two men can use to handle heavy lifts. They consist of a block with chain and a worm gear to give great multiplicity of power
chart - a map of a portion of the ocean or navigable waters of the world, emphasizing information useful to sailors
chipping hammer - for chipping and scaling metal
chock - a fitting secured to the vessel's deck or on a pier, having two arms between which lines or cables can be passed--some are open, some are closed
chronometer - a fine accurate clock, set to Greenwich time; used for navigation
cleat - fitting of metal with two horns and used to secure lines
coaming - a raised framework around the deck area to keep water out
cofferdam - a small space left open between two bulkheads to protect against heat, fire hazard, or collision damages
coil - to lay rope down in circular turns
collision bulkhead - the first watertight bulkhead aft of the bow
companion - a covering over the top of a companion way
companion way - set of steps or ladders leading from one deck to another
compartment - space below decks and between bulkheads comprising the "rooms" of the vessel
compass - instrument to indicate direction
compass rose - a diagram of a compass card on the navigational chart
conn - to steer a vessel
cordage - general term for all kinds of rope or line
course - direction that a vessel is moving, expressed in degrees

dead ahead - directly in front of the bow, and in line with the center line of the vessel
deadlight - metal plate used to protect glass ports
dead reckoning - determining ships position by direction and progress from a known point of departure
deck - floor
deckhand - seaman
diesel engines - oil burning, internal combustion engines used on vessels
displacement - weight of water displaced by the ship
documentation - papers showing type of work a vessel does
dog - metal fitting used to secure watertight doors

dolphin - cluster of piles for mooring
draft - depth of water from the surface to the ship's keel
draft marks - six-inch high numerals with six inch spacing between them. The bottom of each numeral rests on an even foot of draft. Thus, if the water covers half of the numeral 8 of the draft, the draft is 8'3". Draft marks are painted on both sides of the bow and stern.
drydock - a dock from which the water can be pumped
dunnage - loose lumber used to protect the cargo and vessel from damage

ebb tide - tide going out
end for end - to reverse position
ensign - national flag
escape hatch - hatch, usually small, installed to provide a means to get out of a compartment when the normal way out is blocked
eyebolt - a bolt with an eye or one end used for securing purposes

fairlead - a block, ring, or shiv (through which a line passes to prevent chafing)
fair tide - running in the same direction as the ship
fair way - an open channel; also mid-channel
fake down a line - to lay out a line in long lengths, each succeeding length alongside the other
falls - the line in a block and tackle, especially the end that is pulled
fast - to secure, make fast any line to a cleat, bitt, or other fastening device
fathom - six feet
fathomer - instrument to measure water depth
fender - rope gear, wood, or other type of chafing-gear hung over the side of the ship, to protect the vessel when alongside docks or other vessels
fid - a tapered wooden pin used to separate strands when splicing a heavy rope
fire axes - for use in emergencies only, and located on each vessel so that they are easily accessible
fire extinguishers - portable fire fighting equipment containing chemical to put out fires; should be readily available on the vessel.
flood tide - flowing toward land
fluke - the broad end of each arm of an anchor
fog bound - when a vessel is at anchor because of fog
fog signal - sound signal given in daylight or dark in "thick" weather of any kind
foul anchor - a chain of cable twisted around an anchor
founder - to sink
frame - ribs of a ship that support the plating and add strength
free board - distance from waterline to main deck
freeing ports - holes in bulwarks that allow deck wash to drain off into the sea

galley - ship's kitchen
gipsy - drum on a small winch for heaving in a line
ground - to run ashore; strike bottom
ground tackle - term for all anchor gear
gunwale - the upper edge of a boat's side
guys - wire or rope used to support booms or other objects

handy billy - a small portable pump
hawse holes - openings at the end of hawse pipes where anchor chains run out
hawse pipes - iron pipes in the bow through which anchor chains are run
hawser - heavy line, 5 inches or more in circumference; used for heavy work, towing or mooring
head - toilet compartment
headway - forward motion of the ship
heave - to throw the line; to pull on a line; also, the rise and fall of ships at sea
heave in - to haul in
heave to - head the vessel into the wind or sea and hold her there, using engines and rudder
heaving line - small line thrown to a dock or vessel to pass a larger line
heel - to list over to one side, as in heavy sea
hull - the body of a vessel, not including its masts and rigging
hull down - describing a vessel in the distance with only her superstructure above the horizon

inboard - toward the center or toward midships from outside of the ship
inland Rules - rules enacted by Congress to govern navigation of inland waters of the United States. This is part of the "Rules of the Road."
inshore - toward land
International Rules - rules established by agreement among maritime nations governing the navigation of the high seas. Part of the "Rules of the Road."
Irish pennant - loose end of a line

jetty - landing, wharf, or pier; also a dike at the mouth of a river or harbor entrance
jury rig - makeshift gear used in an emergency

kapok - water resistant fiber used in lifejackets
keel - longitudinal beam or plate at the extreme bottom of a vessel running fore to aft
knot - a nautical mile or 6,080 feet (statute mile is 5,280 ft)

labor - a vessel "labors" when in heavy seas
ladder - metal or wooden stairway
lee - away from the direction of the wind

leeward - same as lee
lifeline - a line along the deck for the safety of crew and passengers during heavy weather; also a line thrown to rescue a person who has fallen overboard
life raft - a float constructed of suitable material to provide flotation for a specified number of persons
light list - publication issued by the U.S. Coast Guard, showing location and details of aids-to-navigation
limber holes - holes in the framework of a vessel that let bilge water drain to the lowest part of the hull for collection and removal
line - the equator; also term for rope, cable or wire rope
list - to lean to one side
lock - section of a canal used to lower or raise vessels
log - short for logbook, official record of the vessel's activity
lubber's line - the line marked on the inside surface of a compass bowl to indicate the direction of the ship's bow
lyle gun - gun rigged to fire a line to ship in distress

machinery compartment or space - engine room and space for the auxiliary machinery
make water - to leak
manhole - hole in a tank or compartment designed to allow a man to enter for cleaning and repairs
marlinspike - pointed steel instrument used in splicing wire rope
masthead - top of the mast
plating - the steel plates that form the skin or shell of the vessel
Plimsoll mark - the mark stenciled on each side of a vessel to mark the highest permissible load water lines for specific conditions
porthole - an opening in ship's shell plating
port lid - hung at the top by a hinge to cover a port in foul weather
portside - the left hand side of a vessel looking forward
privileged vessel - the one that has the right of way
prolonged blast - a blast of 4 to 6 seconds duration
prow - that part of the bow above the water
purchase - a general term for any mechanical arrangement of tackle using a combination of pulleys to increase force

quadrant - metal fitting or framework fixed to the rudder head to which steering cables are attached
quay - a wharf or landing place to handle cargo; pronounced "key"

rake - angle of vessel's mast from the vertical
reeve - to pass a line through a lead, such as a sheave, fairlead, pulley, or a hole designed for a line
ribs - frames of a vessel to which the shell plating is secured
ride - to lie at anchor; to weather a storm safely

rigging - general term for ropes, wire, chain, and all gear used to operate equipment
right - to return to normal position
rove - see reeve
Rules of the Road - regulations enacted to prevent collisions at sea
running lights - lights required by law to be shown by a vessel underway between sunset and sunrise

salvage - to save a ship or cargo from danger or to recover a ship or cargo from disaster and wreckage
scope - length of anchor chain out
scupper - opening to carry water over the side
secure - to make fast; to tie
seize - to bind with small line or rope
set - direction of a tide or current
shackle - U-shaped piece of steel bar with eyes in the ends for a bolt to pass through and close the U
sheave - wheel of a block over which the rope or line reeves; pronounced "shiv"
sheer - curvature of ship's deck from bow to stern
shot - short length of chain, usually 15 fathoms
side lights - red and green running lights carried on port and starboard side respectively
skeg - continuation of the keel aft to protect the propeller
slack - the part of a line hanging loose
slack tide - no horizontal motion
soft patch - a plate put on over a hole in the hull and secured with tap bolts
splice - to join tow lines by tucking the strands of each into the other
spring - mooring or docking line leading at an angle of about 45° from the center line of a vessel
stanchion - metal upright used as a support
starboard - right side of a ship looking forward
station bill - listing of crews drill stations
sternway - movement of ship in direction of stern
stopper - short length of line or chain, secured at one end; used in checking a running-line or holding something fast temporarily
stove in - broken in
stow - to put gear in its proper place
swallow - aperture in a block through which the rope passes
swash plates - plates with holes fixed in tanks to prevent excess movement of liquid

tackle - a purchase, or set of blocks (usually two) in which a rope or chain is rove for obtaining a mechanical advantage in hoisting or pulling
tail shaft - the after end of the shaft which receives the propeller
take a turn - to pass a turn around a cleat and hold on
three-fold purchase - a tackle, both blocks of which contain three sheaves

thwartships - at right angles to fore and aft line
tow - to pull through the water; also vessels or barges being towed
two-blocked - when two blocks of tackle have come together; also to be stopped or stymied
underway - a vessel is underway when not at anchor, aground, or made fast to the shore (dock, pier, etc.). The vessel need not be moving. She is underway if she lies free in the water.

voids - empty spaces inside a vessel for safety and stability

watertight door - constructed so that when closed it will keep out water under pressure
weather deck - exposed to the weather
weeping - slow seepage of water through the seams of a vessel, tank or container, in sufficient quantity to produce a stream
weigh - to lift the anchor off the bottom
whipping - keeping the ends of rope from unlaying by wrapping with twine and tucking
wildcat - sprocket wheel on a windlass for taking chain cable. The sprocket has pockets designed to fit the chain links.

yaw - to zig-zag back and forth